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The Public Lighting Tables of the American Meter Company will be found in the page advertisement of that Company.

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[OFFICIAL NOTICE.]

Twenty-first Annual Meeting of the Ohio Gas Light Association.

OHIO GAS LIGHT ASSOCIATION,
OFFICE OF SECRETARY,
DELAWARE, O., Feb. 14, 1905.

The Twenty-first annual meeting of the Ohio Gas Light Association will be held at Pittsburg, Pa., March 15th, 16th and 17th.

The President, Mr. F. W. Stone, of Ashtabula, O., will call the meeting to order on Wednesday, March 15th, at 9:30 A.M., in Assembly Hall, Hotel Schenley, the headquarters.

The following technical matters will be presented at the meeting:

"Question Box;" edited by Mr. Henry L. Doherty, New York city.

"Progress Department;" edited by Mr. Irvin Butterworth, Grand Rapids, Mich.

"Novelty Advertising and New Business Methods Department;" edited by Mr. B. W. Perkins, South Bend, Ind.

"Wrinkle Department;" edited by Mr. E. E. Eysenbach, Binghamton, N. Y.

"Information Bureau;" edited by Mr. H. L. Olds, Lincoln, Ills.

"Bureau of Forms and Records;" edited by Mr. D. W. Low, Alliance, O.

Reports of Committees.

"Question Box, Revision Board;" Dr. H. B. Harrop, Chairman, Milwaukee, Wis.

"Uniformity of Gas Meters;" Alten S. Miller, Baltimore, Md.; Donald McDonald, Albany, N. Y.; R. Shacklette, Adrian, Mich.

"Standard Sizes for Coke;" C. W. Andrews, Duluth, Minn.

"Uniform System of Mapping Mains;" W. H. Barthold, Grand Rapids, Mich.

"Standard Methods of Testing Fuel Gas Appliances;" Henry L. Doherty, New York city; F. W. Stone, Ashtabula, O.; John Franklin, Cincinnati, O.

"Flow of Gas in Pipes;" J. D. Shattuck, Chester, Pa.; H. A. Carpenter, Pittsburg, Pa.; J. O. Johnston, Columbus, O.

"Standard Methods of Construction and Operation of Coal Gas Benches;" W. A. Baehr, St. Louis, Mo.

"Fuel Economies;" C. H. Williams, Madison, Wis.

Set Papers.

"Removal of Last Traces of Oil and Tar from Water of Condensation;" by Mr. James S. McIlhenny, Washington, D. C.

"Piping Gas Long Distances;" by Mr. W. H. Hammon, Pittsburg, Pa.

"Installation and Care of Exhausters;" by Mr. E. D. Johnson, Connersville, Ind.

"Producer Gas;" by Mr. Edward R. Wood, Jr., Philadelphia, Pa.

"Large Gas Engines;" by Mr. J. R. Bibbins, Pittsburg, Pa.

An opportunity will be given any of the speakers present at the meeting to correct their remarks before leaving Pittsburg, but not after, as all of the reports will be turned over to the printer immediately after the meeting.

The Hotel Schenley is conducted on the European plan, and the following rates have been secured for the meeting: For single room without bath, occupied by one person, $2 per day; single room with bath, occupied by one person, $3 per day; room without bath, occupied by two persons, $3 per day; room with bath, occupied by two persons, $4 per day.

The Schenley is a most modern hotel, pleasantly located at the entrance to Schenley Park, and can be reached by trolley within 15 minutes from all railroad depots. They hope to entertain all of the Association and will put forth every effort to make the members com-

LIBRARY OF CONGRESS. MAR 8 1905. SMITHSONIAN DEPOSIT.

fortable. The most satisfactory quarters are always obtained by writing in advance to the hotel people.

Pittsburg is one of the most interesting towns in the country for gas men, and the local Entertainment Committee is arranging a programme relative to visiting the different industries. The announcement thereon will be made later. The Secretary will furnish with pleasure application blanks for membership, and any other information which may be desired.

T. C. JONES, Secretary.

[OFFICIAL NOTICE.]

Respecting the Official Work of the American Gas Light Association.

AMERICAN GAS LIGHT ASSOCIATION,
SECRETARY'S OFFICE,
530 Broadway, N. Y., Dec. 13, 1904.

To the Members American Gas Light Association: As there seems to be some misunderstanding respecting the standing of the official management of the Association, members will please note that the undersigned is the Secretary of the Association, and that Mr. A. E. Forstall is carrying forward the work of the Practical Class. All correspondence in connection with the Practical Class should therefore be addressed to Mr. A. E. Forstall, 58 William street, and all other matter pertaining to the Association to MR. GEORGE G. RAMSDELL, Secretary, at the above address.

BRIEFLY TOLD.

THE COMING-OF-AGE MEETING OF THE OHIO GAS LIGHT ASSOCIATION.—With the near approach of the calendar spring comes the meeting of the Ohio Gas Light Association, whose coming-of-age sessions will be held in a State that beheld not its birth. However, that is not unusual in the anniversaries of "humans," since many a man, having gone from the home of his parents, failed to return thereto or even keep track thereof—sometimes much to the relief and comfort of the parents. The twenty-first session of the Ohio Association, apart from philosophizing or deduction, will be held this year in Pittsburg, Pa., and the direct particulars concerning it are set forth in the well-put-together notices that have been published in the JOURNAL over the signature of the Association's Secretary, Mr. T. C. Jones, of Delaware, O. That the place selected for headquarters and meeting room is ample one may not doubt, since the Hotel Schenley and its equipment are fully up to any demands that may be made upon them. It is worthy of note that the prices for accommodation are, to say the least, liberal. The programme arranged on technical account should require the undivided attention of the members through the entire sessions devoted to business; that is, if each subject is to be given the consideration which its merits deserve. It looks, though, from the plethora of matter named for dissecting, that something must be slighted if fair cutting is to be given to any. The programme on entertainment account is in capable hands, and its pleasures no doubt will be all the more enjoyed through failure to announce the numbers in advance. One thing "sure and certain" is that President Stone will have a large audience to direct. It is further understood that Secretary Jones has been obliged to purchase a third ledger for membership accounting, wherefore we are shortly to have some later knowledge as to the strength of numbers.

A TRIBUTE TO THE LATE MR. JAMES SOMER'ILLE.—Mr. James Ferrier, President and Manager of the Rome (Ga.) Municipal Gas Company, writing to the JOURNAL under date of the 28th ult., says:

To the Editors AMERICAN GAS LIGHT JOURNAL: It has been well said that those who are subject to a man's orders are in the best position to form a true judgment of him. I had the advantage of holding such a position when I made the acquaintance of the late James Somerville, and my experience then and since enables me to say this of him: I have not known a nobler man or a friend more true. In him our country loses one of its best citizens, and the gas industry one of its ornaments.

NOTES——

THE Light and Power Committee of Kingston, Can., has recommended to the City Council that the selling rate for gas be put at $1.50 per 1,000 cubic feet (a cut of 50 cents per 1,000), the concession to date from July 1st.

THE proprietors of the Hartford City (Conn.) Gas Light Company have sold the Company's handsome office building to the Travelers' Insurance Company. The offices of the former will, after the 1st prox., be located in what is known as the McKone building, 565-67 Main street, which premises have been leased for a term of 20 years.

MR. JOHN MARBURY, for many years prominently identified with the Georgetown (D.C.) Gas Company, died at his home in Georgetown the afternoon of February 16th. He was in his 83d year, having been born in Georgetown, October 4, 1822.

[OFFICIAL REPORT.—REVISED BY THE SECRETARY.]

THE THIRTY-FIFTH ANNUAL MEETING OF THE NEW ENGLAND ASSOCIATION OF GAS ENGINEERS.

HELD IN YOUNG'S HOTEL, BOSTON, MASS., FEB. 15 AND 16, 1905.

FIRST DAY—MORNING SESSION.

The thirty-fifth annual meeting of the New England Association of Gas Engineers was called to order, in Young's Hotel, Boston, at 10:30 A.M. of Wednesday, Feb. 15th, by the President, Col. Frank S. Richardson, of North Adams, Mass. Secretary N. W. Gifford was seated in the Recorder's chair.

ROUTINE BUSINESS.

On motion of Mr. Allyn the reading of the minutes of the 34th meeting was dispensed with.

Next in order came the following:

REPORT OF THE BOARD OF DIRECTORS.

To the Members of the New England Association of Gas Engineers: Your Directors would recommend for election the following named gentlemen:

Active.

Geo. H. Priest, Supt. and Treas., Greenfield (Mass.) Gas Light. Co.
Guy K. Dustin, Supt., Hartford City (Conn.) Gas Light Co.
Francis S. Thayer, Supt., City of Norwich (Conn.) Gas and Electric Department.
Oscar R. Tinker, Supt., Winnepesaukee Gas Co.
Robert E. Wynant, Engr. and Supt., New Haven (Conn.) Gas Lt. Co.

Associate.

A. P. Beardsley, Chemist, New Haven (Conn.) Gas Light Co.

Honorary.

We also recommend the name of Mr. F. C. Sherman, of New Haven, Conn., for election to honorary membership in the Association.

The resignations of the following have been presented and your Directors suggest their acceptance:

R. J. Monks.	Lewis Bartlett.	W. K. Stratton.
J. K. Montgomery.	C. A. Lomax.	S. E. Gillette.
W. M. Stearns.	I. E. Coffin.	C. A. Tucker.

We also recommend that members two years in arrears in dues be dropped from the list of names.

The following Papers and Short Topics have been examined and approved for your consideration:

"Some Practical Record Sheets;" by Mr. W. L. Walker, Fitchburg, Mass.

"Gas Mantles and Gas Mantle Lamps from a Commercial Standpoint;" by Mr. W. R Addicks, New York.

"The Relations of Firebrick Material to Retort House Construction;" by Mr. H. A. Carpenter, Pittsburg, Pa.

"Ammonia;" by Mr. D. D. Barnum, Worcester, Mass.

Short Topics.

"Working with Deep Purifiers;" by Mr. C. H. Gifford, New Bedford, Mass.

"The Tar Situation;" by (?)

"Grounding Wires on Gas Pipes;" by Mr. E. H. Yorke.

The President—You hear the report of the Directors as read by the Secretary. What is your pleasure?

On motion of Mr. Lamson the report was accepted.

ELECTION OF NEW MEMBERS.

At the suggestion of the President (and on motion of Mr. Lamson) the Secretary cast the ballot of the Association for the gentlemen named for election to membership by the Board of Directors.

The Secretary having announced the result, which result was reannounced by the President, in so far as the ordinary membership was concerned, on motion of Mr. Lamson, the proposition to elect Mr. F. C. Sherman to honorary membership was adopted by rising vote.

RESPONSE OF MR. F. C. SHERMAN.

The President—Mr. Sherman, it is with pleasure I report to you your unanimous election as an honorary member.

Mr. Sherman—Mr. President, I thank you and the Association most sincerely for the honor you have conferred upon me. I shall feel that I am in good company; but if it means that I am to be neglected in the way of annual dues, I shall want to decline the honor. I shall insist on paying my proportion of the expenses in the future, as in the past.

Thanking you again, let me say I shall do all that I can to promote the growth and interests of the Association in the future as in the past.

The President—Mr. Sherman, the motive that actuates you to make your expression is one of many that has endeared your membership to this Association, and in this or any other action of yours certainly the Association is honored in having your name appear in the list of honorary members. It is a very great pleasure to the Directors to have made this recommendation.

Vice-President Africa assumed the Chair, and President Richardson read his

INAUGURAL ADDRESS.

[For the text of President Richardson's address, see JOURNAL, Feb. 20, 1905, p. 283.]

On motion, the address was referred to a committee (Messrs. W. A. Wood, Chas. F. Prichard and Chas. H. Nettleton) for consideration and report.

The President resumed the directing of the meeting. The

ANNUAL REPORTS OF THE SECRETARY AND TREASURER

were then read, accepted and ordered filed, as was the

REPORT OF THE LIBRARIAN.

In connection with the Librarian's report the following discussion took place:

Mr. Allyn—I would like to inquire of the Secretary if there has been any record kept of the number of members who took advantage of the opportunity to refer to the books in the Library.

The President—Thank you, Mr. Allyn; you have relieved me of a duty—I was going to say pleasure—that of asking for the figures. I was going to make a computation as a little foot note in the address which I read.

The Secretary—I would like to state that the members of the New England Association of Gas Engineers are, first and foremost, pre-eminently and before all else, modest. For their accommodation, and as a matter of record, a register has been placed in the Library for them to write their names when visiting it, but their modesty has forbidden them writing their names, so that the great use of the Library is not shown on any record. I think there are 5 names on the register.

The President—Mr. Allyn, that in a way answers your question, and still it does not. There may have been 500 members visiting the room. I knew there were only 5 names on the register, but as I have been there twice, and did not register at all that makes seven.

The Secretary—That bears out my statements.

Mr. Allyn—I have been there twice, in custody of the Librarian and Commodore McKay. I should not have thought of going there either time if they had not seized on me each side and escorted me up.

The President—Did you register, Mr. Allyn?

Mr. Allyn—I don't remember.

The Secretary then read letters from many prominent gas men regretting their inability to be present at the meeting.

ON THE MATTER OF ELECTROLYSIS.

The President—The next order of business calls for reports of committees. A committee was appointed to report upon the present status of electrolysis in its various phases. Is the committee, through its Chairman, ready to report? Mr. Chas. F. Prichard, of Lynn, is the Chairman, the records show.

Mr. Prichard—I was under the impression that Mr. W. R. Addicks was Chairman of that Committee.

The Secretary—The records I believe do not confirm the gentleman's recollection.

The President—In view of the fact that Mr. Addicks is absent, and won't be here, naturally you are the second if not the first member, and it will be incumbent upon you, as the acting Chairman, to report now.

Mr. Prichard—I think that possibly misunderstanding as to who the Chairman was may be the reason why no meetings have been called and no business has been transacted. We will see that another year possibly something is done.

The President—That may apparently be a reason, but I don't think that the Association would really like to accept it. Still, if there has been no business, and if there have been no meetings held, and that is your report, we must take it.

Mr. Prichard—Yes, sir.

The President—You have heard the report of the Committee on Electrolysis by its acting Chairman, Mr. Prichard. What is your pleasure?

Mr. Lamson—I move that it be accepted, with a proper reprimand.

Mr. Allyn—I would like to amend by adding the matter of general discussion among those present. If any members have had any experience in the beauties of electrolysis during the last year or otherwise, I think it would be a benefit to the Association to listen to it.

The President—We will act upon the amendment, and leave the original question before the house to be voted upon after the discussion, which will be opened by Mr. Prichard, is ended. Have you any fact in your own experience to state, Mr. Prichard; that is, locally in Lynn?

Mr. Prichard—I don't know that anything has transpired within the last year or more that is at all different from what we have been having for quite a number of years. I think it is generally accepted that it is entirely within the power of the street railway companies to avoid doing any damage to the underground pipes, if they choose, by a better system of bonding their rails than they now employ, and by the use of return wires from the rails to some suitable overhead return conductor. There is no question they can do that and there is no question that they have done it in many cases. However, there is no question that a lot of underground damage is going on, directly due to their slackness—I don't know any other word—or to their lack of attention to that thing, which is very important to us but not at all important to them. In our own particular case we have had no trouble to amount to anything for quite a good many years. We formally filed notice with the railroad company whenever we had any damage to services or otherwise and have always rendered them a bill. I am sorry to say they have paid none of those bills as yet. Nevertheless, we keep up the practice, and when there is any damage we send them a detailed bill of all the work which we do, and we try to collect it. As far as I have any knowledge, the only result is getting a large, red apple from the superintendent.

The President—That is something.

Mr. Prichard—That is looking in the right direction, certainly. We have adopted one little scheme or wrinkle to help us in this matter. In one square, and in another place by the depot where there is considerable traffic, we have reduced the services to a minimum, and then have covered them with earthenware, ordinary sewer pipe, supporting the service on the inside as best we can with little blocks of wood. We find that services which only lasted a short time when they were exposed to contact with the earth last a very much longer time when this is done, and I think perhaps we may say that we have had no trouble from services protected. That is my own experience.

The President—Are the joints cemented, or put loosely together—that is, the joints of the soil pipe covering?

Mr. Prichard—I do not know. Mr. Mason who is here can say.

Mr. Mason—Entirely; the end, the joint and everything. They are perfectly air-tight.

The President—Mr. Ralph Woodward, of Pittsfield, is here. There is a long line of 3½ miles of high pressure gas service running from Pittsfield to Dalton, parallel to which over part of the line the trolley road runs. Can I ask Mr. Woodward if they have experienced any difficulty or damage in Pittsfield from electrolysis?

Mr. Woodward—We have not experienced any difficulty with electrolysis on that line. The insulating joints were put on less than 500 feet apart, and the railroad—and we go by its power house—has been apparently well built; it is well bonded and we have had no trouble at all. Perhaps our President can tell the Association something out of his experience.

The President—Are there any other members who are suffering from this trouble?

Mr. Allyn—Mr. President, as far as the Cambridge gas works are concerned, we have had no complaints to make for several years. When we first discovered that electrolysis was doing serious injury to our pipes we notified the railway company, and after considerable litigation with them they consented to put in heavier bond wires and double bond every rail, and, as I said, very little damage has been done since, as far as we know. But the city has been having some pretty serious experience. Some 5 or 6 years ago, I think more as a matter of economy than good judgment, they laid a mile or two of steel pipe—I think it was 40 inches diameter and about ⅝ inch thick. Over a large extent of the territory through which this pipe runs I think no damage has been done, but in one section, perhaps ¼ of a mile, in very wet ground—in fact, the hill through which this pipe runs is impregnated with running springs—they discovered last spring that the pipe was being ruined. They uncovered it for a length of about ½ mile, and I suppose there is hardly 6 inches of the surface of that pipe in any one place that has not been affected; and it was affected very curiously, differently from what we have seen it on previous occasions. It looked as if you had taken a round pointed drill and drilled into the surface of the pipe. In some cases it went through, so that when they uncovered

the pipes streams of water would play up, but in other places the holes were so near together that they would join each other so as to make a patch as large as your hand, perhaps. The water department has been a good deal puzzled as to what to do with it. It has some fear that it may extend to this whole section of pipe and cause very material damage.

The President—Are there any others who will contribute personal experience on this?

The Secretary—I would like to ask some of the experts how nearly clean the good practice leaves the lines in regard to the stray currents, whether or not they can clean them up absolutely, so that the volt meter won't show any current travelling between the rails and the pipes. I have recently run across a few places where it looked as though the pipes had been affected, but tests that I had made showed the current flowing from the rail to the pipe at that point, which I understand is not damaging the pipe then. I would also like to ask whether or not there has been any legal definition of the position of the railroads in regard to the pipes.

The President—Which one of the experts here will answer the question propounded by the Secretary? Or will any of the members offer to throw light upon this important question.

Mr. Allyn—I meant to state, Mr. President, that the metropolitan water system has also had very serious trouble in the near vicinity of the power station on Boylston street, Cambridge. That is quite close to the river. Some of their 32 and 40-inch pipes, which have only been laid about 3 years, I think, have been entirely destroyed; they seemed to be converted into carbon, so that you could take a jack knife and whittle off the bells of the pipe. Those pipes had to be removed, and new ones put in their place. It seemed to be only in the immediate vicinity of the power station.

The President—I would say that the high pressure line from North Adams to Adams, which runs 6 miles south, and 4 miles directly parallel with the Hoosac Valley street railway track, nearly the entire distance of that measurement within 40 to 45 feet of its rail, is I fear suffering disintegration. The section directly opposite the power house of the Street Railway Company gave evidence of a leak. We were 11 days finding it, which was speedy in view of the fact that it appeared in a house 240 feet south from the hole that was eaten in the one pipe by the electrical current. We took out that length, and in the 22 feet there were 17 pits. I am just reminded that I was very careless in not having brought the matrix paper that we took from that length of iron pipe. I will telephone, however, to the office at home directly we adjourn, and to-morrow I hope to be able to show you the 17 points of attack on that one piece of pipe. There was only one through puncture. It was about the size of a lead pencil, but under the pressure (from 7 to 17 pounds) it made anything but desirable conditions to meet, and, in the midst of this very severe and unusual weather, meant a matter of physical endurance and great expense. We also have an insulating joint every 500 feet in that line, but it is a fact that that in itself is a fundamental reason for great trouble, in that every 500 feet is a section which can be attacked, and as the pipe runs through very moist and absolutely wet earth there is so much current at the present time that it jumps that joint. We have examined 4, and the 2 ends of every pipe that come to the opposite side of that insulation are each very badly pitted. Just what we are going to do it is impossible to say. But I can answer a question asked here by saying that no legal opinion has yet been rendered upon that question. It is being considered by a very excellent authority in this State, and an opinion is to be rendered to the Massachusetts railway companies. Perhaps Mr. Prichard knows of that fact. We have a very large bill against that Street Railway Company for damage done some years ago, before we assumed ownership and control of the Adams Gas Company. It has never been paid, the street railway company contending they are not responsible for the loss of gas, the total of which was charged in the bill. They did state their willingness to pay, however, for the labor and the other expenses. We now have the problem again in very acute shape. They were not very prompt in responding to our request, nor did it appear to them very important when describing the possible danger to life and property and that Adams (a place of 11,000 people) might be entirely deprived of gas. Had a section as large as one's hand been eaten out and fallen from that line pipe, the service would have been interrupted until a new section of pipe could have been put in. Of course, we could not pump the further section (from that break to the Adams side) full of gas up to 30 pounds, and thereby get enough in the line itself to last 3 or 4 hours, because we could not get it past the break. The Railway Company have at last reversed their current, or they have taken the negative out and brought back the positive, which, of course, reverses the point of attack on the pipe, and the current will enter where it went off, consequently we hope that the pipe is strong enough to last until the spring comes. If it lasts 3 months longer we are hoping that another puncture will not appear; but in that particular case, and under those natural and necessary conditions that exist, I very much fear, unless the Street Railway Company, when running parallel to our pipe, resort to the very best known method, we will always have trouble. Now, it is a question whether the street railway companies can be made to do it—whether they will acknowledge their moral obligation; but it is a point of law and also of common sense, that no corporation has a right to maintain and operate a nuisance upon its own property to the detriment or harm of anyone else. That is common law. In my opinion when this matter is considered by a final tribunal, street railway companies will be made to ackowledge absolutely their responsibility.

Mr. Prichard—Do they have any return wires?

The President—They did have one, but I think it is broken. I believe the fundamental trouble in that particular case is the business has increased so that the amount of current coming back to the station does not find the easiest path in the company's old equipment; but it is a truth that the greatest evidence of these conditions will be found in 9 cases out of 10 opposite the power station. That can be entirely remedied by taking out those insulating joints on the high pressure and making that a return, bonding the pipe and connecting it to the switchboard. That, however, makes you a part of the system of the street railway company; you are then their assistant carrier, and there is the danger that current is always there. If any repairs are being made, especially on a high pressure system like ours, and there is enough current when the pipe is drawn apart to make a flash, it will be a very serious proposition—extremely so; one that is fraught with serious danger and menace to life and property.

Mr. Prichard—It seems to me that is just the point that should be dwelt upon. There is no reason why they should use our pipes for their purposes.

The President—None whatever.

Mr. Prichard—And that is exactly what they do. There is no financial reason why they should not, nor physical either, return their current properly from the rails to an overhead conductor and back to the station. It would not be a burden for them to do it, and if they did it properly we would have no trouble whatever. I am not a believer in the attempt to insulate sections of pipe, because it is bound to develop in moist ground the feature that our President speaks of. The current is bound to jump around those joints. I believe a cement joint, which cuts up your pipe every 12 feet, is an assistance in insulating your pipe. This is the first case that I heard of where what is apparently a long line shows electrolysis. It usually, in cases that I have heard, comes in public squares and places of that kind, where there is a coming together of a lot of cars and a large amount of current poured into the rails at a particular time; it either comes there or else at the station. If they have insufficient conductors to take the current back to the station and they are pouring current into the rail all over the city that has to get back to the station. If your pipe or the water pipe forms a better conductor than they offer the current will go back on that pipe, and then, somewhere in the vicinity of the station, will leave your pipe and the water pipe and go to the station underground, taking with it metal from the pipe, which, of course, is the cause of all the trouble. I should imagine, possibly in President Richardson's case, that if they ran a wire from the pipe back to the switchboard it would temporarily help quite a bit.

The President—That is what we intended to do, and what we will have to do, but, as a general proposition, there is no more reason why that should be continued, and that nuisance and those untoward conditions maintained, than that any of us should allow a low pressure distribution to be maintained in any town or city where there might be a hundred leaks and say, "Why; that is all right. We can't help that." We can help it. We have to help it. Not only that, but we do help it. By that same token, I think you will learn in the final conclusion that the street railway company will be compelled to; but incidentally it is a hard proposition, and we are suffering.

Mr. Allyn—I should like to inquire whether the pipe spoken of by the President is of wrought or cast iron?

The President—It is an extra heavy, lined wrought iron pipe, with the Dresser couplings and these insulating joints. It runs in one direction almost 6½ miles, and in very moist soil; in fact it runs in muck for 3 or 4 miles. They are ideal conditions to attract, that. When you take the other fact, that the rail is very imperfectly bonded, especially where all the turnouts above the power house run into the car

barns, it gives ideal conditions there to ruin the gas company's equipment. Are there any others who can and will take part in this discussion.

Mr. Cathels—I may say that the north station of the Providence Gas Company is located within probably 200 feet of the electric light station, and that in any part of our plant we can find electric current on the pipes and the apparatus. We have had on two or three occasions to cut our larger pipes in the works, and—you brought this to my mind—we have always taken the precaution to take a stout piece of copper wire and make a loop around that cut-out before we commenced making the cut-out. We have not experienced any serious injury from electricity around the plant, except in one deep well. We have a well about 250 feet deep, which is probably 300 feet from the power station, and we have had to renew the pipe in that well twice within two years.

The President—Did the railway company pay for it?

Mr. Cathels—We also have an oil pipe line running between our plant and the electric light plant. We have had an electrical expert go over the plant on one or two occasions and found the oil pipe in bad condition. We have a bill at the present time pending against the electric lighting people.

The President—That is the universal experience; to have a bill pending against them.

Mr. White—Mr. Briggs, of Cleveland, O., made some statements recently concerning the policy in that city which may be of interest to the Association.

The President—The statement certainly will, Mr. White.

Mr. Briggs—The Street Railway Company never hesitates at all in making a settlement for any damage caused by electrolysis, both to the water and the gas companies. I have noticed a great many times in passing through the streets that with all plumbing, service work, and things of that kind, the Railway Company sends an inspector and takes the piece of service pipe, of any description, and turns it into the office. Bills are rendered, and settlement is made in full for all cost for that purpose.

The President—I know no reason why they should not. If they do it in Cleveland they ought to do it in Massachusetts.

Mr. McKay—Has Cleveland a double or single trolley system?

Mr. Briggs—The single overhead wire system.

Mr. Coggeshall—Just a question; I don't know whether it has been settled or not. Has the city of North Adams or Adams given the privilege or right to the railway company to locate the tracks in certain streets. If you run through those streets after that should you assume the responsibility?

The President—It might appear so at first sight, but let us follow that a little further. By that same token, then, whoever is first in the field might upon those lines of reasoning be allowed to maintain any sort of nuisance. Supposing you or I came first with the gas main, and we say, "This line is good enough." "Well; it leaks." "That does not make any difference. That is our business. We will stand the leakage." Now, we would not want to be allowed to maintain a thing like that, which would be not only a nuisance but a menace. No; you are suffering from absolute neglect, and failure to comply with reasonable, inexpensive and necessary methods to make the equipment right and proper.

Mr. Coggeshall—I don't see myself why the cities, which suffer very much more than the gas companies do, don't bring this thing to a head and know what the liability is. I don't know why the street railway companies should not be responsible.

The President—I don't; and I think in the end it will be found that they are responsible. I would say that it is unknown to me that in our locality (the northern part of Berkshire county) any of the water pipes have suffered at all.

Mr. Coggeshall—In Fitchburg we have not suffered. I don't know of an instance where we have suffered from electrolysis; but the water company and the city have, and they have had some 5 or 6 cases of it.

The President—Is it not a fact that the Street Railway Company in Fitchburg have resorted to the modern method of welding the joints all through the city?

Mr. Coggeshall—Yes.

The President—And that in itself may account for the immunity from trouble.

Mr. Coggeshall—But they have been running there for 10 or 12 years before this, and we have never suffered at all that we know of.

The President—It is a very serious question.

Mr. Coffin—I would like to ask Mr. Sanderson if there has not been a decision in some Western city holding the companies responsible for this. I think I read it in the American Gas Light Journal.

Mr. Sanderson—I think you are right. In Peoria, Ills., Spokane, Wash., and Indianapolis, Ind.

Mr. McKay—I think that, in Atlantic City, N. J., the court having the proper jurisdiction required the railway company to substitute for their single trolley system the double trolley system to obviate electrolysis, from which the water and gas companies were suffering.

The President—The substitution of that system would be an absolute protection, as everyone knows.

Mr. W. A. Learned—Wasn't that the time when they were giving this railway company a charter?

The President—I could not say. I am unaware of the fact. If so, it was a very fortunate fact for the people in that territory.

Mr. W. A. Learned—What do you propose to do while you are waiting for the decision of the railroad; say, for instance, next spring when the frost is out of the ground?

The President—We propose to trust in Providence and keep the fire under the portable boiler at North Adams already to run out, and we have issued a notice, not only to every foreman but to all the employees, that no meter shall be removed on the high service line until it is cut around; a path is made with a wire from the house piping to the service piping. In each service pipe we propose to put a small Dresser coupling, if we can an insulating joint, and take them out from the main. Then we are going to do the best we can with the Hoosac Valley Street Railway Company. This is a very important subject, gentlemen, and it is extremely interesting.

Mr. White—What is the result since the railway company reversed the current?

The President—That was reversed just a week ago yesterday. We have made no tests in the opposite direction, from the rails to the pipe, since then; but we found a maximum of 25 volts, and as high as 14 amperes, on a test we made directly opposite the power station, and that is some current. I have referred to a piece of pipe which showed 17 pits. We took that length of pipe out and made a matrix upon each point attacked. I have 17 papers, and I will have them sent down by express to-day and hope to show them to the Association to-morrow, because it is really a quite remarkable exhibit that within 22 feet those should happen, including one puncture. It is different whether the pipe will discharge gas under 3 ounces or 17 pounds. Are there any other contributors to this fund? It is a fact that an important question has been asked by the Secretary, Treasurer and Librarian as to how much current, if any, will be left when the track is properly bonded. Has anyone been through this experience, making the proper test to indicate the volume of current before and after?

The Secretary—If the experts are shy about answering, I might put it in this way: On finding how little current need we be alarmed? Otherwise, if we find 2 volts, is that a dangerous condition, or can we be satisfied if we get less than 2 volts or less than 1 volt or less than ½ volt?

The President—I am not an expert, but as to the business end of it I would say that any is unfortunate. In very moist ground it is a fact that some evidence of the electrical current will be observed when there really is absolutely none being thrown off, and under those conditions I don't see how it can be entirely eliminated, though in snch small quantities, in my opinion, it is not a source of absolute damage to the gas pipes. At the present time it is like the lion and the lamb endeavoring to lie down together. The next business is the election of officers, and it is necessary and usual for a Nominating Committee to be announced by the President. I will appoint as such committee Messrs. W. E. McKay, Charles D. Lamson and H. K. Morrison. Next in order is "general business," the details of which are in charge of the Secretary.

A Telegram.

The Secretary—A telegram just received is this:

"Fully expected to be with you, but prevented by snow blockade yesterday. Best wishes for one more excellent meeting added to your score, and renewed regrets at my personal dissapointment."—F. H. Shelton.

Reading the Papers.

The President—Have any members any items to present, or are there any that are known to be considered at this time which would come under the head of general business? If not, we will proceed to the reading of papers. The first will be that by Mr. Walter R. Addicks, of New York, on

GAS MANTLES AND GAS MANTLE LAMPS FROM A COMMERCIAL STANDPOINT.

It will be read by the Secretary. We are all very much disappointed

at the last moment that Mr. Addicks cannot be present. He is ill, he has been suffering like many others, and it will be impossible for him to be present at this meeting, a fact we deplore, for his presence will be greatly missed. The Association will listen to the reading of the paper by Mr. Addicks.

The Secretary read as follows:

Your President has asked me to address the Association upon a topic that he seems to believe will be of general interest. I fear some may think there is a taint of commercialism in my so doing, for the Company with which I am connected as Vice-President, the Municipal Lighting Company, is in a degree in the market for the sale of lamps. While this is so to a degree, it is likewise true that our special field is at home rather than abroad. With this explanation I am glad to add what I can to your professional enjoyment of this meeting. Mr. T. H. Hintze, formerly of Lowell, addressed this Association upon this topic, and you are all invited to read again his remarks thereon.

Why should the gas engineer take his attention from the retort house, distribution, or from the contemplation of the subject of naphthaline, its cause or prevention, and waste his grey matter with gas mantles and gas mantle lamps? The answer to this question to my mind is complete—you gentlemen may not agree with me when I say there is no one subject that in the future means the earning of more money for your stockholders than from this one source. Well; how?

The future will demonstrate that the principal source of all illumination will be the gas mantle. You know that to-day those companies that give most careful attention to their consumers' flat flame burners and troubles, are apt to give the best satisfaction to their clients and with the least complaints of poor gas and poor service. The poor gas mantle is to the good gas mantle a smaller fraction than the poor, flat flame burner to the well regulated, efficient flat flame burner. In other words, the importance of good mantles will be greater than the importance of good ordinary burners. This is why we should study the subject. Do not the electric light companies, in increasing numbers, care for the lamp renewals? So, too, the gas companies must eventually take up the gas mantle end of their industry.

But, begin now, gentlemen, and do so properly. Start with one man, if you please, to properly adjust and keep in repair mantle burners, supplying all needful mantles, supports and glassware, and at the same time charge a profitable amount to compensate you for your trouble, time and material, and keep books and accounts of the cost, charging in all items.

What should your charge be? That is something that depends upon your local conditions.

You will find that a man of good ability can take care of from 40 to 60 4-mantle lamps per day, or 240 to 360 per week—I am inclined to the belief that the lower number is conducive to good service. If you pay $10 per week for labor this would be, say, 4 cents per lamp per week, or $4\frac{1}{2} \times 4 = 17\frac{1}{2}$ cents per month.

If you agree to supply as many as 3 mantles a month, and they cost you, say, 12 cents each, this item of cost would be 36 cents. You have to take care of billing lamps, making out bills, collecting, etc. Perhaps you had better allow nearly as much more labor for this item—say 14 cents per month—so that you have a charge of 50 cents per lamp per month for labor and material.

Suppose your lamp cost you $6 and it cost you $2 to set it, including shop expense, or a total of $8. Let us allow 5 per cent. for interest, 5 per cent. for profit and 20 per cent. for depreciation on lamp, including glassware if you lease the lamp, otherwise, when maintaining only 10 per cent. for repairs, including glassware.

This is a total of 30 per cent. on the first cost, which would be $8 × 30 per cent. = $2.40 per year, or 20 cents per month, or a total, including maintenance and office charges, of 87 cents per month.

This does not allow anything for superintendence or insurance, taxes, payment of claims, bad debts, rent or other charges that the business, standing as a business alone, must meet. You will find before the year is up that it is not easy to collect your bills in summer. You will find, if you lease lamps, that you will have to remove many, and the expense of setting a lamp is lost to you, and that it must be charged into expense. I do not advise anyone to lease lamps with weekly inspection and cleaning for less than $1 per month at the start.

Do not deceive yourself by having labor put on this work and say it does not cost you anything. All my previous remarks refer to lamps used within doors. I think you will find such lamps use as much as 1,250 cubic feet per month, or 15,000 cubic feet per annum. If you should ultimately make in your maintenance department 40 cents per lamp per month you will be receiving $40 \times 12 = 480$ cents, or $\frac{480}{15M} = 32$ cents per 1,000 on the gas sold by the appliance.

If your lamp is a 6-mantle lamp for outdoor use, I would not advise anyone to attempt leasing such lamps for less than $1.50 per month, with weekly inspection, but these mantles are larger mantles usually and the return on gas will be found nearly double in quantity that of an indoor lamp. The cost of setting will be found to be double that of an indoor lamp and may be even larger. No rule can be laid down for any particular locality. It will depend entirely upon the cost of labor and material.

Single mantles may be maintained for less perhaps than cluster lamps, but I would prefer to consider them on the same basis; that is, if a 4-burner lamp costs 40 cents per month, I would not advise considering less than 10 cents per month as the cost to the company, without profit, of single mantle burners. If you lease lamps, don't carry a cheap lamp in stock Get a well made lamp. Don't carry more than one make of lamp, unless for commanding reasons, for then your spare repair parts will be less numerous. While you may lease lamps, I would suggest you sell them and maintain them for the purchaser at a profit—I would not recommend maintenance at less than 75 cents per month with weekly inspection, including glassware. Remember, if you lease you run the risk of a new lamp making your leased lamps out of date.

Now I want to warn those undertaking this work that they must have a contract signed. It must be a good contract, one that the consumer can cancel at any time. All our contracts contain a clause that they may be canceled at any time, if payments are up to date, by paying one-half the amount still due thereon.

Suppose you have a lease at $1 per month for 12 months, and that your cost for maintenance is 50 cents per month, then we have the following—profit includes installation, interest, depreciation, etc.:

12 months at $1 = $12, less maintenance, $12 \times 50 = \$6 = \$6$ profit.

1 month at $1, less 1 month maintenance at 50c. = 50c., or $\$0.50 \times \frac{1,100}{2} = \$6$ profit.

2 months at $1 = $2, less 2 months' maintenance at 50c. = $1, or $\$1 \times \frac{1,000}{2} = \$6$ profit.

3 months at $1 = $3, less 3 months' maintenance at 50c. = $1.50, or $\$1.50 \times \frac{900}{2} = \$6$ profit.

And so on to 11 months at $1 = $11, less 11 × 50c. = $5.50, or $\$5.50 \times \frac{100}{2} = \$6$ profit.

It is the same to you whether the consumer keeps the lamp or not. If the contract is canceled, you can clear the lamp for 50 cents, and release it so that you can get a second profit from the same lamp from someone else.

If you can, it is much better to get a payment for installation the first month and make the payments $1 a month until payments amount to a total of $12 and maintain it at least 12 months from date of contract. Thus—

$3 down and $1 per month for 9 months.

If your consumer then cancels in 3 months, we have:

$3 down	= $3.00 ($2 + $1 maintenance 1 month).	
$1 × 2 months =	2.00	
	$5.00 total.	
Still due $7 ÷ 2	= 3.50	= $8.50 in 3 months.
Less 3 mos. maintenance at 50		1.50
		$7.00 profit.

Otherwise:

3 months at $1.00	= $3.00	
Still due $\frac{900}{2}$	= 4.50	
	$7.50	
3 mos. main. at 50c	= 1.50	
		$6.00 profit.

Always make payments monthly in advance.

If in the above case the one-half is not paid as per contract you have in the first case:

$3.00 down.
2.00 paid.

$5.00

$1.50 maintenance.

$3.50 to pay for installation and repairs to lamp, which may cover your loss.

But in the second case cover your loss:

3 months at $1 = $3.00
3 months maintenance = 1.50

$1.50 to pay for installation and repairs to lamp, which means you have probably made a loss in the operation.

If competition is sharp you will have difficulty in getting paid $2 for installation. You will find less competition in outside lamps than in the case of inside lamps.

I would again suggest that you try the plan of maintaining lamps; but don't try to do it cheaply.

Have your maintenance men nicely uniformed. Have your men supplied with a good "kit," and maintain a good standard. Don't haggle about how many mantles you supply. Give good service first, last and all the time, and charge fair prices for the service. You will soon find that strict inspection of your maintenance men is a necessity and as a check on your customer they must be supplied with a card for your customer to sign weekly. In short, you will quickly get plenty of experience in addition to any of my hints to you.

If these few generalizations are of value to any of you, I am glad. Anyone in the gas business will receive a kindly welcome in New York and will be shown more in detail our system, if you think us worth a visit.

[To be Continued.]

The Testing of Gas Coals.[1]

Who originated the English method of testing gas coals, is an inquiry that may perhaps engage the attention of some future Dryasdust. Not that there was anything particularly brilliant in the idea; for it must have occurred naturally to the practical English mind that the best and, in fact, the only way (short of a trial on a working scale) to prove the value of a coal gas for producing purposes is to subject it to distillation in a miniature gas works. What might, however, have happened, or after what elaborate preliminary investigation the system would have been evolved, had chemists ruled in the earlier days of gas lighting, can only be inferred from the paper which was read before the meeting at Hanover last July of the German Association of Gas and Water Engineers, by Professor Drehschmidt, the Chemist to the Municipal Gas Works, of Berlin, and reported in the *Journal* for August 16.

This is not said to detract in the slightest degree from Professor Drehschmidt—who is derservedly held in the highest esteem by his colleagues—or his work, which speaks for itself; but the paper serves to illustrate the different way by which an engineer and a chemist may arrive at practically the same goal. It is a description of an experimental gas works which has recently been installed at Berlin, and of a number of tests made with it. It commences with an account of the steps that had previously been taken to arrive at the value of gas coals by some method other than the use of a gas making plant, and more in consonance with pure science. "Endeavors," it says, "had repeatedly been made to take the chemical composition of coal as a basis for their classification."

At first it was supposed that the so-called available hydrogen in the coal—namely, that which remained when the quantity required to form water with the oxygen of the coal is deducted from the total amount of hydrogen present—was the most significant factor. It is found, however, that the total proportion of hydrogen in coal fluctuates within quite narrow limits; while there are much greater differences in the proportion of oxygen present. Thus with 68 varieties of coal examined at the Berlin Gas Works, the difference in the hydrogen found was at most about 1½ per cent.; while in the oxygen there was a difference of 10 per cent.

A more hopeful basis for determining the value of gas coal was the oxygen present; and the paper quotes M. St. Claire Déville as having arranged coals into 5 classes, according to the amount of oxygen they contain; it being found that, on carbonization, as the proportion of oxygen in the coal increased, the yield of coke fell, and the total make of volatile products—viz., gas, tar and ammoniacal liquor—increased, though the volume of gas became smaller. This rule is not, however, without its exception; and, as observed by the author of the paper, it leaves the gas manager in the lurch in regard to the matters which most concern him—namely, the yield and quality of the gas. Interesting, therefore, though such investigations undoubtedly are, they can hardly be expected to appeal very strongly to the practical gas maker.

A proposal to carbonize a small sample of the coal in a platinum crucible is also dismissed by the author as being of doubtful value; and he thus arrives at the conclusion long ago reached in this country and elsewhere, that the gasmaking qualities of a coal can only be determined from practical carbonization. Whether, however, this should be conducted on what may be termed a laboratory scale as often practised in this country, where experimental plants for carbonizing the $\frac{1}{100}$th part of a ton are not uncommon, or on a scale more nearly approaching that of a full sized gas plant, had next to be determined. The Professor is of opinion that the results to be obtained by means of a miniature gas plant—carbonizing, say, from 1 to 2½ pounds of coal per charge—are not reliable, for the reason, apparently, that variations of the temperature materially affect results. This, however, applies to any retort, whether large or small, and, therefore, can hardly be regarded as of itself conclusive against the adoption of a very small retort.

In support of his view, Professor Drehschmidt quotes an example of variation which relates to charges on a working scale, of 309 pounds and 351 pounds, carbonized at different temperatures and worked off in 5 hours and 6 hours respectively. Experience thus gained may be, and no doubt is, applicable to much smaller retorts, but, standing alone, can be no reason for rejecting their use. In point of fact, a very small retort is a most serviceable instrument, because, when gas fired from any ordinary gas supply, its temperature can be regulated to almost anything that may be desired. At the same time it is true that the smaller the scale upon which an experiment is conducted, the less chance there is of obtaining accurate results as regards yield of tar and ammoniacal liquor, if for no other reason than that any trifling error in the estimation of these becomes greatly magnified when brought to the standard of per ton of coal. This, however, is of less importance since the yield of such bye-products must always be to a great extent subservient to that of gas.

Of greater moment is the determination of the quantity and quality of the coke produced, because upon these depend the efficient and economical heating of the retorts, and, to a great extent, the disposal of the surplus. A very small charge of coal is of little service for ascertaining the size, density, and general appearance of the coke yielded by any particular coal. For this information reference is necessary to a charge weighing not less than ¼ cwt., and even then the results can only be regarded as comparative. Chemical analyses, are, of course, required to determine the amount of ash and purity as regards presence of sulphur—matters which are generally considered as being beyond the control of the gas maker, and to which, therefore, not much attention is usually given. The gas maker, however, who fixes his eye solely on the yield of gas, places himself at a disadvantage. Gas must be his first consideration; but the other items of profit and loss account have also claims on his attention.

In the economy of gas manufacture the receipts for coke have a prominent place, and the more that is known of the good and also of the bad points of this residual, the better it must be It may not always be the possible to eradicate the latter by changing the coal; but, at all events, a knowledge of them may help in the selection of suitable markets. In this connection the communication by Herr Stack, of Hanover—which was read at the same meeting—entitled "The Use of Gas Coke"—should prove of service. Although not directly applicable to the conditions which prevail in this country, it points to the possibility of finding additional uses for gas coke, if they are diligently sought for.

The author of the paper supports his preference for an experimental apparatus approaching in size that of an ordinary gas plant, by pointing out that when the conditions of carbonization are altered, the whole of the volatile products are affected in regard to their quantity, nature, and action one upon another. Granted that this is so, the question then arises, is the full sized gas plant the most suitable for obtaining the best all-round carbonizing results. Some will answer this in one way and some in another; for there is considerable diversity of opinion with regard to the very foundation of the position taken up by Professor Drehschmidt. The veteran gas maker, Mr. George Anderson, many years ago pinned his faith in small retorts, and, so far as is known, has never had any reason to regret having done so; while the recent installation of 12 inch diameter retorts at East Greenwhich will occur to every one.

It may therefore be regarded as undesirable to produce, in the shape of experimental gas plant, an imitation of retort house practice. What

1. *Journal of Gas Lighting.*

should be aimed at rather is an apparatus by means of which the full gas producing value of a coal can be ascertained, no matter how much this may be in excess of the value obtained in the retort house. From such an apparatus it should be possible to learn, not only the *comparative* value of all coals submitted for test, but also something of the conditions under which the best carbonizing results are to be obtained; and this, with intelligent observation, should prove to be not the least valuable of its uses. Even in this respect, however, an experimental gas works has it limitations, and must not be too greatly relied on.

It is worth knowing by those who in this country lay stress upon the desirability of having their experimental plant upon what they call a working scale, and expend—not to say waste - much money on this object, that Professor Drehschmidt, though impressed with the desirability of approximating the dimensions of a full sized gas plant, realizes to the full the objection to employing a setting having a number of retorts. "With such a setting," he says, "and still more with several settings, it becomes difficult to maintain the retorts at a uniform heat, or to alter the heat according to the nature of the coal under examination. Moreover, a large quantity of coal would be required for testing and the whole of the retorts cannot be charged simultaneously; so that it becomes impossible to follow precisely the course of carbonization hour by hour." These practical observations of a member of a profession not generally credited with practical vision, are a rebuke to those who think it a very excellent thing to reproduce in their experimental plant—regardless it may be of expense—the imperfections of the retort house.

The experimental plant at Berlin, then, was made to consist of a single setting of only two retorts, 9 feet 2 inches long by 20½ inches by 15½ inches, with semi-producer firing. It may be suggested that even this small number is one too many. It was, however, believed that the favorable results which such a setting should afford—these being independent of all the irregularities of full scale working—would serve as an ideal to be aimed at on the works, and indicate changes and improvements for adoption in the latter. With the aim which is thus indicated, we are entirely agreed. It is claimed that these expectations were well founded, since in 1902, the yield of gas per ton of coal carbonized at the Berlin works rose to 11,490 cubic feet from 10,952 cubic feet in 1901, when no experimental plant was used for studying the coals.

It can hardly be necessary to follow the Professor through his description of the plant beyond the retort setting, since in only one respect can any variation of this materially affect results. The efficiency of the purification and the elimination of bye-products may be taken for granted. The only exception that may be made is in regard to condensation. It is clearly undesirable to lay down any hard-and-fast rule as to the kind of condenser to be used, or the extent to which contact between gas and tar should be promoted. These are matters that may very well form the subject of experiment having regard to the unsettlement of opinion respecting them.

There is, however, one matter to which attention should be directed, because it is of particular importance, especially if horizontal condensers be employed—viz., the temperature down to which the gas is cooled. This should be kept to one thing, as far as practicable, because otherwise the results obtained will not be comparable The same coal will produce quite different results with a variation of 10° or 20° in the temperature down to which it is condensed. Uniformity in this respect can generally be obtained by the use of a water condenser.

To return to carbonization. The mode of working in regard to this is described in the paper as follows: The setting was heated to a high or low temperature, according to the origin of the coal to be examined, and the two retorts were then charged simultaneously—the charges, amounting to 309 pounds or 331 pounds per retort, had been previously weighed in the charging scoops. As fresh coals are more or less damp, and it was important to be independent of irregularities, in order to obtain strictly comparative results, the coal had previously been spread out in thin layers in a covered space, until the proportion of moisture had fallen to 2 per cent. on the average.

Observation of the rate of gas production each hour, and especially in the last hour, and of the phenomena when the retort was opened, showed whether the charge had been completely worked off in a given time. If it was not completely worked off (as was usually the case at the first trial), then alterations were made, according to circumstances, either in the heat, the weight of the charge, or the time for working off, until the most favorable carbonizing result had been secured.

It is further mentioned that these three chief factors in determining results had frequently to be altered—more especially with English coals—owing to trouble with thick tar; and that, when the most suitable conditions had been ascertained, carbonization was followed under them for at least 3 or 4 days, and the mean result for these days was recorded Hourly readings were taken of the pyrometer, the thermometer, the water meter, the pressure gauge and the gas meter.

There can be no doubt of the painstaking character of the testing according to this method; but since each test is made to occupy at least 3 or 4 days, it is evident that not more than 60 to 70 tests can be made with a single plant in a year. How would this suit the English gas maker, who is called upon to test, and does actually test in the course of only a few weeks, perhaps from 50 to 100 samples? Is the method which he employs—of necessity a far more rapid one than that which is under consideration—less reliable than the latter? With all respect to Professor Drehschmidt, we think not.

A single small retort will save both time and money; for the rest of the plant need only be proportioned to it, and, instead of one test occupying at least 3 or 4 days, it need not take more than as many hours, even if ¼-cwt. charges are employed. With this weight of charge, the time required for burning off will vary considerably with the quality of the coal, although the temperature of the retort may remain fairly constant. The time limit is in fact of itself an excellent test of the suitability of a coal, having regard to the conditions of practical carbonization, for it indicates, in connection with the latter, the variation of temperature that may be required to yield the best results. A good plan to follow is to keep the charge in until the yield of gas slows down to a given rate per unit of time. Then time the duration of the charge, alter the temperature accordingly and repeat the charge With a small retort, too, the gasholder may be sufficiently large to take the whole of the gas yielded by one charge of coal, and thus avoid the necessity for any proportionating arrangement.

The paper concludes with some very interesting comparisons between samples of English, Westphalian and Silesian coals tested by the Professor. From these it appears that the amount of ash is highest as a rule with the Westphalian and English coals, reaching sometimes as much as 20 per cent. The English coals could only be carbonized at tolerably low temperatures if severe tar stoppages were to be avoided. Silesian coal gave the least difficulty in carbonization. The use of the latter may to some extent account for the higher carbonizing temperature employed on the Continent than in this country. At the same time English coals held their own there for gas producing value; as evidenced by the favor in which they continue to be held. It is, however, mentioned that these coals yield more volatile sulphur than Westphalian and Silesian, the amount of sulphur in the purified gas being the highest with English coals.

This is a point deserving the attention of English gas makers who desire to see their cost for purification kept down. There are plenty of gas coals to choose from, and would be more if the means of transport did not restrict the fields from which supplies can be drawn, and the selection should in all cases be made according to value as ascertained by careful analyses, covering all essential points.

The Naphthaline Question.

The *Gas World* reports that at a meeting of the Yorkshire Junior Gas Association, held the afternoon of the 11th Feb., at the Technical College, Bradford, England—the President (Mr. W. Cranfield) in the chair—Mr. J. F. Smith, Halifax, read a paper reopening the discussion on "Naphthaline" which was started at the last meeting of the Association by Mr. J. H. Brearley, Longwood. The main portions of the paper follow:

Bowditch in his "Analysis and Use of Coal Gas," published in 1867, says that there can be no more mistaken practice than to cool coal gas to a temperature bearing some approximation to that of the surrounding atmosphere, and that it is in the power of most gas engineers to make a considerable difference in the illuminating power of all the gas they manufacture by the adoption of a better mode of condensation. The proper object of condensation, he says, is the removal from the gas of substances produced in the distillation which, for some reason, are not useful for the purpose of illumination, or cannot be distributed, but all substances which are useful as illuminants, and can be distributed with the gas, should be retained. In order to accomplish this, the hydraulic main should be kept hot, and the gases and vapors passing from this should be passed to a special apparatus, kept at a regulated temperature, in which the gas and light hydrocarbons might be separated from the heavier bodies before passing to the purifying apparatus, so that a larger proportion of the hydrocarbon vapors might be distributed with the gas.

This method of condensation, he suggests, would probably tend to lessen the deposition of naphthaline in the gas mains, which then (in 1867) caused so much trouble, as the deposition cannot take place in the presence of a considerable quantity of hydrocarbon vapors, and in another way the heavier compounds which form tar have a strong affinity for naphthaline at high temperatures, and as they condense they are apt to carry down the naphthaline with them, and so much of it would be carried down with the heavier tar that the vapors of the lighter oils would be able to uphold the remainder, and thus the stoppages of mains would become a very rare thing, if not a thing unknown. After the gas has passed through the hot condenser, he suggests that it should pass through another condenser, the outlet temperature of which should be kept as high as possible in accordance with efficient purification. Though he does not mention the temperature, it is evident that he considers 90° F., or over, about the proper one to use.

There is no doubt that fractional condensation in connection with coal gas is a process worthy of further study; but the process laid down by Bowditch requires very carefully looking into before adopting it in practice, for there is a weak point which, if not remedied, would lead to dissapointing results. The weak part of his process is in keeping the hydraulic main hot. He has, unfortunately, not stated the temperature that this should be kept at, but it is evident from what he says that about 400° F. would be the temperature chosen, for he points out that the lighter hydrocarbon vapors would not be absorbed at this temperature. If the hydraulic main were kept at this temperature a large amount of naphthaline would be carried to, and through, the special fractionating apparatus by the steam from the ammoniacal liquor which would be present in the gas at this stage. Therefore, if the hydraulic main is kept hot, naphthaline, along with oils, will be carried forward by the steam contained in the gas, while in the special separating apparatus there would be a mixture of naphthaline, oils and water vapor, so that it would be expected that a large quantity of naphthaline, and of the lighter oils, would be carried forward to the cooling apparatus proper. In this there would be a further deposition of these substances, but at the outlet. The gas would be saturated with moisture and naphthaline, while the light hydrocarbons would be less than would be expected in the gas, owing to the absorption of some of them by the heavier hydrocarbons and solid naphthaline which would be deposited in the last condenser, though the temperature of the outlet of this may be kept at 90° F., or thereabouts. The gas leaving such an apparatus would gradually cool as it passed through the mains to the washing and scrubbing plant, so that moisture and naphthaline would be deposited in quantity, and would, in time, have to be dealt with.

If fractional condensation is to be used in the manufacture of coal gas, or any other gas in which large quantities of naphthaline and water are produced, care will have to be taken to remove as much water as possible at an early stage, in order to get rid of this carrying action of steam. It may be mentioned that the carrying power of steam is due to the fact that tar and water are non-miscible, and when two such substances are heated to boiling it is found that this temperature is lower than the boiling temperature of either constituent of the mixture, which is due to the vapor pressures of the mixture being equal to the sum of the vapor pressures of the two substances. Some time ago this was very forcibly brought to the writer's notice when carrying out some experiments on the absorption of naphthaline by washing with creosote oils, which were undertaken in order to test if a fact well known in physical chemistry could be applied to this process, and which may be stated as follows: When the temperature of a solvent is raised above the melting point of the substance to be dissolved, the substances are miscible in all proportions.

It was thought that by keeping the temperature of the heavy or creosote oils at about 82° C., the maximum amount of naphthaline would be absorbed, and at the same time the loss of illuminating power, due to the absorbent power of these oils for the hydrocarbon vapors, would be overcome without the use of benzol, as was proposed by Messrs. Leather and Irwin. On carrying out the experiments it was found that water and then naphthaline condensed from the gas passing from the absorbing apparatus, though the creosote oil was not saturated with naphthaline. On examination of the creosote oil it was found to contain 3 per cent. of water, which apparently caused the trouble. The same thing can frequently be observed when the fractional distillation of tar which contains naphthaline and high percentages of water, during the first part of the distillation will condense on the beak of the retorts.

The fractional condensation of coal gas seems to be best carried out by separation of as much as possible of the heavier tar fog and ammoniacal liquor, by means of the "Cyclone" or other separating apparatus as soon as possible, and to keep the temperature of the first portion of the condensers at such a point as will allow the condensing hydrocarbons the full play of their absorbing power, without increasing the amount of the naphthaline by the water vapor present. Such a process could be rendered more valuable by increasing the amount of the lighter tars, which condense at the cold end of the condenser, by introducing them free from water, at the warm end of the condenser, and so increase the light hydrocarbons in the condensing system that would be useful as illuminants, and which could be easily carried by the gas.

Dr. Colman's system of condensation has practically the same end in view as that of Bowditch, though in his process the trouble caused by the water vapor is greatly diminished by separation of the heavier tar fogs and liquor from the gas before it reaches the condenser, which increases the vapor pressure of the lighter hydrocarbons, and allows them to exert their solvent action more fully on the naphthaline present, while they are being liquefied and falling through the gas in the cooler parts of the condenser, and at the same time increasing the light hydrocarbons at the outlet end of the condensers. In order to get the fullest amount of usefulness out of the lighter tar that is thrown down in the condensers it is run back against the stream of gas, and in order to still further free the gas from naphthaline, and where the amount of light oils is not sufficient to affect the sufficient removal of the naphthaline, to revolatilize in a simple manner the lower boiling portions from the previously separated tars.

It will be seen that in this process the aim is first to remove the substances that cause the lowering of the vapor tension of the useful constituents, so that they may have fuller play of their solvent action and increase their vapor tension in the outlet gas, which will contain an increased amount of the illuminating hydrocarbons, and, further, where the lighter fractions are insufficient they are increased from the condensed tars by evaporation, so that the molecular percentage is increased in the condensing system. As a result of this, the amount present in the gas at the outlet of the condenser will be also increased.

The use of solvents for washing gas in bulk on the works is gradually becoming more general, but the several processes that are being used are practically the same in principle, namely, bringing into contact with the gas a solvent for naphthaline to reduce the quantity present in the gas at the outlet of the apparatus, in order that there should not be any likelihood of deposits being formed in the mains while the gas is being distributed. The most important point in the process is to select a solvent that has a good affinity for naphthaline and one that does not reduce the illuminating power of the gas by the washing process; at the same time it must not be too volatile. While the solvent is removing naphthaline it is also dissolving other hydrocarbons from the gas, so that the vapor tension of the solvent is gradually altering as the gas is passed through it,

It appears that a solvent having a slightly higher vapor tension than would correspond to the amount of hydrocarbons present in the gas would be the one to use, for if the gas were saturated with naphthaline the vapor tension of the solvent would be gradually lowered until it would not give the necessary vapor tension, when the amount of naphthaline it would usefully absorb had been taken up, so that before choosing a solvent it would be necessary to obtain some data as to the amount of naphthaline, condensible hydrocarbons, and their illuminating value at the inlet and outlet of the washing apparatus for different amounts of solvents, and the amounts of naphthaline taken up.

The principles that govern the process of condensation to a very large extent govern that of the washing processes, and can be applied to these, for in them the substances are first absorbed and afterwards evaporated; but if this is to be done it must be remembered that the molecular percentage of the fraction to which the solvents belong has been increased. It is not absolutely necessary for gas to be saturated with naphthaline when it leaves the condensers to enable it to deposit this substance in the mains, etc., inside the works, for the processes of purification reduce the bulk of gas, and the reduced bulk may not be able to carry the naphthaline; consequently, deposits are often found at the outlet of the clean water washer and inside fouled purifiers, and in some cases they have been found in the gasholders. The writer has seen several pounds of naphthaline thrown over the side of a gasholder tank when a holder has been allowed to become too full and blow.

It is necessary to be very cautious in adopting new processes for the removal of naphthaline on the works, for if a number are tried one after the other until at last one appears to be doing good, judging by the number of complaints in the district, we may be led to think that it is all due to the one in use when the complaints begin to be reduced, when really the credit should have been divided, perhaps unequally, amongst all the processes that have been tried, and not the last one alone.

The methods of clearing the main and services, as well as the plant about the works, will vary according to the position in which stoppages occur. If stoppages occur where there are blank flanges, or hand-holes, the best thing would be to scrape out the deposit and completely remove it. In places where this cannot be done use a solvent which can be readily removed from the pipes, etc. If the places where the deposits take place are before the purifiers, a crude solvent, such as crude naphtha or light oils, can be used, but, if they occur after the purifiers, crude products should not be used.

Various methods of clearing street mains of naphthaline have been proposed. One of which a great deal has been said is carburetting the gas at the works by means of benzol, carburine, etc., which is said to serve the double purpose of enriching the gas and preventing naphthaline deposits. While the writer admits that the candle power of a gas can be increased by this method, he doubts whether by its adoption a district troubled with the deposition of naphthaline will find much relief until after a very long period by this method alone; for in this case gas containing anything short of its full complement of naphthaline would be turned into the mains, which contain deposits of this substance, and would in time become saturated with it, so that on the lowering of the temperature some deposit would be formed, but at a further distance from the works. If benzol or other enriching or non-enriching oils could be used in very large quantities, so that when the temperature decreased there would be a fog of these substances formed in the gas mains, then some naphthaline would be dissolved, but while the particles of the oily vapor grew larger, and presented a larger surface to the gas, they would also become heavier and fall to the bottom of the pipes, when the absorbent power of the oils would not exert its full power on the gas. Experiments made by the writer show that the solvent will only be about half saturated with naphthaline during this process, when dealing with a gas saturated with naphthaline.

The saturation of gas by vapors of hydrocarbon having high vapor tensions would, of course, be impracticable on the manufacturing scale for a town's supply, on account of cost, and other reasons, but oils of fairly low vapor tensions can be used on account of their easy recovery and preparation for use again. But the tension of these should not be lower than that of naphthaline. The carburation of gas to increase the illuminating power of the gas 1 or 2 candles would not help very much in decreasing naphthaline complaints on the district, though the oils having the highest vapor tensions would help more than those having lower ones.

It has been said that 1-tenth of a gallon of benzol will increase the illuminating power of 1,000 cubic feet of gas, 1 candle. From this we can calculate the increased carrying power of the gas for naphthaline due to this source. One gallon of benzol having a specific gravity of 0.880 would weigh 8.8 pounds per gallon, so that 1-tenth of a gallon would weigh 0.88 pounds, or $0.88 \times 7{,}000 = 6{,}160$ grains; and as the cubic foot of benzol vapor weighs, at 60° F. and 30-inch bar., $\frac{78}{2} \times 37.15 = 1448.85$ grains, then 6,160 grains of benzol would occupy, when in the state of vapor, $\frac{6{,}160}{1{,}448.85} = 4.25$ cubic feet, which would increase the 1,000 cubic feet to 1,004.25 cubic feet, an increase of 0.425 per cent., by volume. As the picking up and carrying of naphthaline in the mains obeys the simple law of vapor tensions, so long as the composition of the gas passing through them remains constant, we can calculate by means of simple proportion the difference this increase of volume will make.

According to Allen's investigation, 100 cubic feet of gas will require 21.66 grains of naphthaline to saturate it at 60° F., so that—

$$\frac{100.425 \times 21.66}{100} = 21.752 \text{ grains}$$

would be carried by 100.425 cubic feet. From this it will be seen that the carrying power is only increased by $21.752 - 21.66 = 0.092$ grain per 100 cubic feet, or less than 1 grain for each 1-tenth of a gallon of benzol added, a result which shows that it would take a very long time to wear down the naphthaline deposits if no other means were to be taken to remove them.

New Coal Developments in England.

By R. W. P.

The long search for coal on the southeastern coast of England has been rewarded by the cutting of a 20-inch seam in the shaft of the Kent Collieries Corporation at Dover, at a depth of 1,276 feet, and about 12 tons of coal have been taken to the surface.

The possibility of coal being found in this portion of England was first seriously considered by Mr. R. Godwin-Austen, who read a paper on the subject, before the Geological Society, in 1855. His hypothesis was not received with much confidence by practical men and financiers, and nothing was done on an adequate scale to determine its truth or falsity until 1886, although Godwin-Austen's surmises were very confidently indorsed by a Royal Commission on Coal Mining, in 1866.

In 1886, Sir Edward Watkin, Chairman of the Southeastern Railway, and the Channel Tunnel Company had borings made to a depth of 1,808 feet. These showed the first seam of coal at 1,204 feet, and that there were in all 5 seams; 1 foot 8 inches, 2 feet 9 inches, 2 feet, 2 feet 6 inches and 2 feet 3 inches thick; the 2 foot 9-inch seam being at 1,808 feet depth.

It is thought that there are coal seams of much greater thickness below those already discovered, and the value of the field will depend very largely on these. Most of the seams already found are too thin for profitable working unless the coal is of a superior quality and the roof is of such a character as to make easy mining. That already mined is stated to be a coking coal highly bituminous and of "superior" quality, and is on top of a 4-foot bed of fireclay, also of "superior" quality, which may make the working of this seam profitable. At a depth of 596 feet the shaft passed through 16 feet of iron ore yielding 46 per cent. of metallic iron after calcining, but its other qualities and impurities are not mentioned.

This discovery may be of vast importance, as local conditions are greatly in its favor. Domestic coal retails in Dover and the surrounding country, at $5 to $7.50 per ton, and no coal is found in any of the southern coast counties except Devon, which has a small and almost useless deposit of lignite at Bovey Tracy, and some unimportant developments of anthracite near Bideford. Only a few of the English counties north of these, and south of the Midlands, are coal producers.

The coal developments at Dover are on the seashore, at the foot of Shakspeare Cliff, and are ideally situated for water shipment and the receipt of mine timbers. They are also connected with the South Eastern Railway. The dip of the strata is slightly eastward, which may indicate that coal may be struck at a less depth in some of the western counties, as these measures are supposed to connect (though not necessarily continuously) the coal measures of the west of England with those of Westphalia.

Coal is being mined successfully, near Calais, France, at a depth of 1,104 feet, which is little more than 20 miles south of, and almost within sight of the Dover works.

The Kent Collieries Corporation has only one shaft and before mining operations will be allowed by the Inspector of Mines, another shaft will have to be completed, which may require 1 or 2 years. There is, however, another shaft over 600 feet deep, which is filled with water, which may be utilized and thus shorten the time when mining operations may be commenced. Should it be necessary to carry the shafts down to a depth of 2,500 feet or 3,000 feet in order to reach more valuable seams, the depth will not exceed that of other English coal mines.

After making due allowance for the enthusiasm of the promoters, and the local press, we think these new developments will be of value, and we shall await with interest more detailed information regarding the quality of the coal, iron ore and clay already discovered.

The American Diesel Engine.

[Read by MR. NORMAN M'CARTY, at the Milwaukee (Wis.) Meeting of the Northwestern Electrical Association.]

Many of your members will remember certain papers published some years ago in regard to the merits of a new invention in prime movers called the Diesel motor.

The claims set forth as to the economy of this device were so large and far-reaching that most practical men received them with a shrug of the shoulders. They were, nevertheless, not only true, but somewhat understated. From the small Diesel motor of 20-horse power, which gave these remarkable results, has grown, by a natural process of evolution, the American Diesel engine of to-day, at present built in sizes from 75 b.h p. to 1,000 b.h.p.

A short explanation of the working of this engine may be permissible as many, no doubt, have forgotten the former explanation, while to others the matter may be entirely new.

The Diesel engine is essentially an oil engine and not a gas engine. Gas engines and previous oil engines which acted on the gas engine principle have all in common the explosion of a charge. This charge is a mixture of a given quantity of gas or of a given quantity of oil vaporized so as to act as a gas during the process, combined with a quantity of air varying from seven to eleven times the volume of the gas or vapor. It was well known that some previous compression would add to the economic results of the explosive action. But in all

cases the power was obtained by an explosion, which, from the moment of ignition, was beyond control of the operator, or of the governing mechanism of the engine. This fact limited the efficiency of all governing devices which could be applied, and troubles with the igniter caused other irregularities, so that even where local conditions made the gas engine (or vaporized oil engine) the worthy competitor of the steam engine, uncertainties of its operation threw doubt on the wisdom of the substitution.

Furthermore, a cheap gas, necessitating the installation of a large and cumbersome producer plant, was the only escape from such costly fuels as gasoline or kerosene.

The Diesel engine made the use of the cheapest liquid fuel, such as crude oil, fuel oil and distillates, possible. To these recent experimental developments promise to add the waste product from gas works known as light water gas tar.

The Diesel engine works on an entirely new principle. First of all, it dispenses with the so-called charge or mixture, which in all explosive engines must vary only between the limits of 1 gas to 7 air, and 1 gas to 11 air. Its cycle is the same as the gas engine, the well-known Otto cycle. There its similarity with the gas engine ends absolutely; in everything else it follows the precedent of the steam engine.

Its first stroke is a suction stroke, drawing in a cylinder full of pure, clean air; on the second stroke it compresses this to a tension and consequent temperature sufficient to ignite any fuel which may be injected into it; at the beginning of the third stroke a small quantity of fuel oil is injected into this red-hot air as a spray by a jet of highly compressed air, and thus, in a completely atomized state, the fuel meets and mixes with the hot compressed air in the cylinder, burning completely, and during a period of time exactly regulated by the governing mechanism of the engine, generally through one-tenth part of the stroke (when engine is operating at its rated capacity), subsequent to which the stroke is finished by the expansion of the burnt product or gases; the fourth stroke discharges these products of combustion and leaves the cylinder empty and ready for another suction stroke.

It is evident that the work expended in compressing the cylinder volume of pure air is given off again to the shaft of the engine during the combustion or motor stroke, so that the loss is simply the fractional loss during the compression stroke.

This simple process, absolutely new and original with Diesel, has enabled him to accomplish with one-half pint of common crude or fuel oil as much as the explosive engine does with a full pint of the much more expensive gasoline.

A recent comparison of results extending over a period of regular daily service of 6 months has shown the consequent economy of a Diesel engine over a first-class gasoline engine, which it displaced, of 600 per cent.

The modest statement set forth some years ago by the promoters of the Diesel engine, and covered by absolute and binding guarantees, are that 100 b.h.p. hours measured in the crank shaft of the engine will require not exceeding 8 gallons of crude oil or fuel oil when the engine is running at or near its greatest capacity, nor more than 9½ gallons when it is running at or near half load.

The regulation in the Diesel engine is not dependent on hit or miss, but can be followed up or down the scale as closely as in a steam engine. In the latter it is a question of cutting off more or less from a pretty large volume of steam at each stroke; in the Diesel engine it is the finer one of cutting off a more or less minute quantity of oil from the small volume delivered by the fuel pump at each stroke. It is accomplished by direct action of the governor on the suction valve of the fuel pump, which is held open during a greater or less portion of the pressure stroke, and thus the pump delivers the exact quantity of oil required during each motor stroke of the engine. While the mechanism is necessarily smaller and more delicate than in the steam engine, it also requires less power and its effect is more immediate.

In a compound steam engine the volume of steam left in the high pressure cylinder at the point of cut-off must be used in the next stroke of the low pressure cylinder, whether at the time more or less would be the proper quantity for that stroke. In the Diesel engine the regulation acts on each cylinder just at the time and in the exact quantity then required

There remains only the drawback common to all 4-cycle engines, that there is but 1 motor stroke for each 2 revolutions. For electric light work, triple cylinder engines and heavier fly-wheels successfully overcome this, while for electric railway work resort is had to still larger fly-wheels and 4 or 6 cylinders by coupling on engines at each end of the same dynamo shaft.

As for the accessibility, reliability and durability of the engine, 3 years of experimental work have placed these fully on a par with the best steam engine practice, and since then, 2 years, and in some cases nearly 3 years, of continuous service by a number of Diesel engines of the new American type give sufficient examples of the success in this work.

An installation of 50 engines, aggregating 6,000 b.h.p., and representing 25 separate and distinct plants, in service from 6 months to 5 years, has so demonstrated the fuel economy that the American Diesel Engine Company offer the following formula to any user of power, by which he may determine for himself the exact cost of fuel from his operating conditions, under the supervision of his own attendants and for any length of time he may desire, the result of which they are ready to guarantee, assuming that the plant has averaged one-half load for the time under consideration:

For Electrical Transmission.

$$\frac{A \times 365 \times B}{8} = \text{cost of fuel per year.}$$

For Mechanical Transmission.

$$\frac{A \times 365 \times B}{10.75} = \text{cost of fuel per year.}$$

In which case—

A = number of kw. hours, or b.h.p. hours per day.
B = cost of oil fuel in cents per gallon.

For example, assuming that an electrical installation delivers 1,000 kw. hours per day, with oil fuel at 3 cents per gallon, we have $\frac{1,000 \times 365 \times \$.03}{8} = \$1,368.75$ as total cost of fuel per year of 365 days. But as the Diesel plant requires no boilers and eliminates the extra expenses of the fire room it should be credited with this necessary charge against a steam plant, so that assuming the charge for water, labor and depreciation of boilers for a steam plant of this size at $2.50 per day, or $912.50 per year, the cost of fuel for the Diesel would be only $1,368.75 — $912.50, or $456.25 per year in excess of fire room charges (exclusive of coal used) necessary for steam, and the total coal bills for a steam plant must be kept within this amount if it would meet the operating expenses of a Diesel plant. But an average steam plant delivering 365,000 kw. hours per year would probably require under actual operating conditions 1,100 tons of coal at, say $3 per ton, or $3,300, and assuming the labor and supplies in the engine room of each plant as equal, the Diesel would make a saving of $2,843.75 per year, or at least 30 per cent. of the cost of installation.

A larger plant, delivering 10,000 kw. hours per day, would cost for Diesel $13,687.50 per year, with fuel at 3 cents per gallon.

Assuming this to be a 1,000-kw. installation, the charges in the fire room of a steam plant (which charges we assume to cover depreciation as well as water and labor) would approximate $5,000 per year, leaving the cost for the Diesel fuel at $8,687.50 in excess of fire room charges for a similar size steam plant, and which must cover coal bills as suggested above, to meet the Diesel economy.

Three million, six hundred and fifty thousand kw. hours for a steam plant would represent at least 7,300 tons of coal, or, at $3 per ton, $21,900, a saving for the Diesel of $13,212.50, equal to 60 per cent. of the coal bill, or approximately 20 per cent. of the cost of installation. The coal consumption being based on 4 pounds per kw. hour, or 2½ pounds per i.h.p., will probably not be seriously disputed by any steam authority, considered as covering average working conditions.

The essential features that distinguish the Diesel engine from all other prime movers are:

1. As all oil fuels have practically the same calorific value, the cheapest is equal to the highest priced for the purpose intended.

2. The fuel consumption being controlled automatically by the governor, the consumption on variable load approaches very much nearer the theoretical requirements than when dependent on manual control, as in a steam plant.

3. The medium for compression being pure air and non-explosive, no back-firing is possible.

4. The ignition being caused by the heat of compressed air, no igniters are necessary, and no mixtures or explosions tolerated.

5. The ignition and combustion are gradual and continuous, with a surplus amount of air to maintain complete combustion. Consequently, no carbon is deposited and no fouling of valves or cylinders possible.

Costs as an Element in Technical Education.[1]

Costs and kindred factors in shop management have come to be recognized as a legitimate branch of engineering knowledge and practice. Without a correct system of costs and scientific and continuous study of methods of production a manufacturing establishment cannot be conducted on its most profitable basis. It is consequently quite natural that technical schools should take up this subject as a part of the engineering curriculum. The Worcester Polytechnic Institute is a pioneer in this direction, having introduced into the engineering course the office end of its Washburn shops, where the students in mechanical engineering receive instruction in the various branches of shop work, in the pat'ern shop, blacksmith shop, forge shop and machine shop. So far the new course is considered an experiment by Prof. W. W. Bird, the head of the department of mechanical engineering. The theory is that the office end of the shop is just as important to the education of the student as the manufacturing departments, and that practical instruction in shop management is as conducive to discipline and development of mind as instruction in any other department, perhaps excepting the class room.

The fundamental purpose of shop practice is to give to the student a correct idea of the theory of manufacture, and in order to acquire properly that theory it is necessary that he do a certain amount of the work himself. In his professional career he will have to do with management, where the products of shop and foundry play important parts. As an engineer he must have more than a theoretical idea of such things, or perhaps it would be better to say that a correct theory must have a practical basis. Consequently, in the modern polytechnic institute the student makes his patterns and molds and pours his castings; learns the proper mixtures for the cupola; works his castings in the machine shop and fashions other metals with machine tools. But he is not expected to become the equal of a journeyman in any trade. Included with this training of the hands is a material training of the mind. All contribute to the mental training, the discipline, which makes of the student the well balanced, highly trained engineer. Nowadays the office end of the business is so very important a factor in the shop itself, especially as work is directed to produce the maximum of economy and efficiency, that it would seem to be imperative that the student of the polytechnic be given a certain amount of that end of engineering.

The senior class at the Worcester Polytechnic Institute was selected as the best equipped from experience to master the principles of costs and shop economies. The course is divided into three parts, in a general way. First, the students were put to work preparing a set of instruction cards for the use of the apprentices, of which the shop has a few. The result was excellent. The task was divided up among the students so that each might specialize on a given piece or part. They went into the shop and made a systematic and accurate study of the work being done. The stop watch played an important part. The exact time required for each given operation was ascertained, and wherever it was seen that the time could be saved by a better method or by getting more work out of a machine it was done. The journeymen employed in the shop first laughed at the work and then felt the stimulus. The whole shop was speeded up. The standard of time which shop custom had set for certain work was found to be completely astray. And all the time the students were learning a great deal about a very important part of industrial management, for modern conditions require just this sort of investigation to bring about a satisfactory margin of profit.

The next part of the course was in the keeping of costs. A standard machine built in the shop and exhibited at St. Louis had to be taken apart for cleaning, and the opportunity was taken to make of it the lesson in costs. The parts of the machine were laid out and divided among the members of the class, each being given one or more pieces and being held responsible. As it is a machine that goes through the shop in lots of 25, the lesson was a good one. The final result was the cost of the entire lot as well as of each operation of each piece. The student received all job tickets having to do with operations on his particular share of the machine. He had to work out the cost from these tickets and to reckon the cost for the next lot of machines. It will readily be seen that many perplexing questions arose for him to master. He learned the lesson of buying, the intricacies of discount sheets. He became aquainted wiih the economics, at times, of producing pieces in greater numbers than the machine lot calls for, in the economical cutting up of stocks, and many other practical things. In addition to the discipline of study he profited by the observation of the evil results of lack of discipline, for he came in contact with the personal equation of the workman, with its possibilities of waste and delay. The third part of the course, yet to come, is in buying and selling including both foreign and domestic shipments.

This course will be criticized by some of those having to do with technical education, on the ground that it is squandering time on the practical side which would be better devoted to the theoretical. Compared to the shop courses of most technical schools, the course at Worcester is practical. What is manufactured by the students is intended for the market. This is the growing tendency of similar institutions, and one in which the manufacturer who employs technical school graduates will heartily sympathize. He wants the solid basis of theory, but he also wants enough of the practical so that the young man fresh from the polytechnic will not have to begin all over again and learn a new lesson at the cost of the time of his employer. There is a happy medium between too much theory and too much practical. In the work of this course in shop management the student gets the same sort of discipline and mental stimulus that he receives from other branches of shop and laboratory work. It is an experiment that will be watched with more than ordinary interest by those whose profession it is to train young men for engineering professions, as well as by those who employ the young men after they have taken their degrees.

1. *Iron Age.*

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

THE lease of the Gas and Electric Cmpany, of Bergen County, N. J., to the Public Service Corporation, of New Jersey, was approved by seven-tenths of the stock in the former. The terms of the lease have been printed in the JOURNAL.

THE following courteous correction carries its explanation:

PHILALELPHIA, PA , Feb. 28, 1905.

To the Editors AMERICAN GAS LIGHT JOURNAL: In looking over the last issue of the JOURNAL, I noticed an incorrect statement. Perhaps it is not of exceeding importance, nevertheless I believe the lines should be made straight. You make note of the fact that Mr. W. A. Miller, Superintendent of the Covington (Ky.) Gas Company, had resigned and that his place was to be taken by Mr. E. H. Earnshaw, of Philadelphia. Reflection will show to you that Mr. Miller was Superintendent of the Cincinnati Gas and Electric Company, and it is from the service of that Company Mr. Miller resigned. His successor with the Cincinnati Company is Mr. E. H. Earnshaw, and he will serve it as General Manager. Mr. Earnshaw for some years was Assistant Engineer to the Philadelphia gas works. Incidentally, Mr. Earnshaw was the guest of honor last night at a farewell dinner served in the U. G. I. cafe by his associates and friends in the U. G. I. Company. More substantial perhaps than the dinner, in that it likely will remain longer with him, was a memento of remembrance in the shape of a very beautiful watch fob charm. Many expressions of regret, in fact, of sorrow, were made over his severing his connection with the U. G. I. Company. Truly yours, D. J. C.

MR. W. B. MILLER, who recently resigned as Superintendent of the Gas Light Company, of Augusta, Ga., is now in full charge of the gas division of the properties of the Birmingham (Ala.) Railway, Light and Power Company.

THE manufacturing plant of the Everett (Wash.) Gas Company will be doubled this year. The improvement scheme also includes the placing of 2½ miles of distributing mains.

THE executive organization of the Copper Range Gas and Coke Company, which concern proposes to supply gas to the residents of Red Jacket, Lake Linden and Hubbell, Mich., is as follows: President, A. G. Griggs; Secretary, J. W. Martin; Treasurer, Charles A. Burr.

THE Washington (O.) Court House Gas and Electric Company has increased its capital stock to $150,000 from $100,000.

A CORRESPONDENT in Malone, N. Y., writes that the Trustees of Saranac Lake village have granted a franchise to the Adirondack Gas Company to lay mains for the supply of gas in that village. The terms provide for a bond of $5,000 to be filed by the Company for the satisfactory fulfillment of the agreement. The grant is to be free of tax until January 1st, 1916, after which date the Company is to pay to the village 2½ per cent. on its total receipts. The plant is to be completed by June 1, 1906, and construction work thereon must be commenced within 6 months. The life of the franchise is for 50 years.

IT is definitely announced that the properties of the Taylorville (Ills.) Gas Company and the Taylorville Electric Light Company have been joined. The succeeding concern is to be known as the Taylorville Gas and Electric Company, and its capitalization is $127,000. Mr. J. C. N. Shumway will be the local manager.

MR. J. C. HENDERSON has been appointed Assistant to the President of the United Gas and Electric Company of New Albany and Jeffersonville, Ind. Our correspondent informs us that Mr. Henderson will have charge of the construction and the "technical" operation of the electric light plants of New Albany and Jeffersonville, the New Albany water works, the street railway lines of New Albany and Jeffersonville and the interurban line between the two cities which is now being extended over the Big Four bridge at Jeffersonville to Louisville. Mr. Henderson came to New Albany several months ago to superintend the construction of the traction line to Louisville. He is an expert electrical and civil engineer, and is an exceptionally capable man for the position to which he has been appointed.

THE following excerpts are from the annual report of the City Gas Inspector (Mr. J. Henry Hoertz) of Louisville Ky., for the twelve-month ended December 31—Comptroller Grout's attention is called to the figure respecting the tests on gas meter account: "During the year there were inspected and proved 1,702 gas meters, of which number 1,551 were new meters and 151 were under complaint. Of the 1,702 meters tested 158 registered fast, the average error being 1.20 per cent., 1,321 registered slow, the average error being 1.98 per cent., and 223 were correct. Of the 150 meters tested from the service 48 registered fast, the average error being 1.98 per cent.; 92 registered slow the average error being 5.24 per cent., and 11 were correct. Of the 151 meters tested for consumers 38, or 25.17 per cent., were correct; 16 or 10.59 per cent. of the number tested were rejected as fast, and 22 or 14.57 per cent., were rejected as slow. Of the consumers' meters the fastest found was 6 per cent and the slowest failed to register at all. The mean amount of sulphur in any form found in the gas was 18 grains per 100 cubic feet. The maximum amount, 19.62 grains, was found in January, and the minimum amount, 15.04 grains, was found in April. At no time during the year did the gas contain more than the legal limit of 20 grains in 100 cubic feet. The average amount of ammonia found in the gas was 0.130 grain per 100 cubic feet. The largest amount found was 0.388 grain, and the smallest amount 0.063 grain per 100 cubic feet. The maximum amount of ammonia allowed in the gas is 5 grains per 100 cubic feet. At no time during the entire year was sulphuretted hydrogen found in the gas. During the year 281 official photometric tests of the gas were made and these showed a mean illuminating power of 18.11 standard candles, which is 2.11 candles above the legal requirement. The maximum was 26.84 candles and the minimum was 15.16 candles. Only once during the year, June 13, did the candle power fall below the requirement of 16 candles. The average specific gravity of the gas was .485, the maximum was .601 and the minimum .455. During the year 22 arc lamps were put in service, making a total of 1,836 lamps in service on December 31, 1904. Each arc lamp costs the city of Louisville $84 per annum. The total cost of the arc lamps for the year was $152,544.47. The lamps are 2,000-candle power and burn on an all-night schedule with a total of 3,761 hours during the year, and for each hour a lamp fails to burn a sum equal to the price of two hours burning is deducted from the bill. During the year the outage was 4,129 hours amounting to $184.45."

MR. EUGENE WAKEMAN has resigned from the service of the Batavia (N. Y.) Light and Power Company.

THE proprietors of the Malden, Medford and Melrose (Mass.) Gas Light Company have ordered the net selling rate to be placed at $1.10 per 1,000 cubic feet.

THE resignation of Mr. F. de V. Thompson as General Manager of the Springfield (Mass.) Gas Light Company does not become effective until the 1st prox.

A CORRESPONDENT in Boston forwards the following: "The Municipal Light Board, of Wakefield, Mass., has ordered a reduction in the selling rate. Under the order the net price will be $1.40 per 1,000 cubic feet."

MR. C. B. STROHN, of Aurora, Ills., has been appointed Manager of the Elgin (Ills.) American Gas Company.

MESSRS. CLARENCE H. GEIST and Knowlton L. Ames, of Chicago, have purchased the plant and franchises of the Fort Madison (Ia.) Gas Light Company. They propose to remodel the plant and extend the main system—in fact, their initial scheme contemplates the doubling of the latter.

THE proprietors of the Southern Light and Traction Company, of Natchez, Miss., inform us that they have decided either to improve the existing coal gas plant, or install a new water gas plant, up to a daily capacity of 60,000 cubic feet. The equipment is to include a a storage holder of not less than 50,000 cubic feet capacity. They are also in the market for several thousand feet of 6, 8 and 10-inch cast iron pipe.

MR. MORGAN MORGANS, of Pontiac, Mich., has accepted the position of Superintendent of the distribution division of the Bay City (Mich.) Gas Company.

MR. GEORGE LEVINGS, one of the founders of the Paris (Ills.) Gas Company, and at one time prominently identified with other gas enterprises in the West, died at his home in Paris the afternoon of February 22d. He was in his 71st year.

ANOTHER prominent figure in the gas business of the olden days was taken out of life's reckoning through the death last month of Mr. Edward Swain, of Bristol, Pa. He had served the Bristol Gas Company as a Director for at least 25 years.

THE Cincinnati Gas and Electric Company proposes to extend its mains to the outlying districts of Pleasant Ridge and Kennedy Heights.

THE newly elected Directors of the Mahanoy City (Pa.) Gas Company have perfected the following organization: President, Edward Silliman; Secretary-Treasurer, Charles S. Parmeley—the latter succeeds Mr. A. B. Wagner, whose relations with the Company end the 1st prox.

THE following bird of a story comes to us by way of Watertown, N. Y. It takes quite some faith to believe in it all; but here it is: "In a suburban town where the streets are lighted by gas lamps, a curious thing happened. A gentleman noticed that for several nights the gas was not lighted in front of his house, and reported the matter to the gas company. The lamplighter who had the street in charge was sure that he had lighted it each night. Later the gentleman noticed that the lamp was often lighted through the day and decided some mischievous boy was responsible for it. Keeping a close watch for the offender, he was astonished to see the light flash up when not a soul was near it. He placed a ladder against the post and climbed up to investigate the matter. He found that the two chains which turned the light on and off moved so easily the slightest touch was sufficient to send it up or down. But they could not move by their own weight, nor by the wind. Still more puzzled, the man returned to his watch at a discreet distance and was soon rewarded by seeing a wren fly to the lamp, perch itself on the ring at the end of the chain, and give it a pull which lighted the gas. He then remembered that a wren had reared a brood in the lamp that year."

THE Public Service Corporation, of New Jersey, will build a 3,000,000 storage holder in conjunction with its gas division in Newark. The site is at the Market street crossing of the Pennsylvania Railroad, close to the Hudson county end of the Jackson street bridge.

THE Covina Valley (Cal.) Gas Company has started in business. It begins with 100 consumers, who have agreed to pay $1.75 per 1,000 cubic feet for the service.

THE Portland (Ore.) Company has arranged to construct a holder up to retaining 1,500,000 cubic feet.

THE Brooklyn (N. Y.) *Daily Eagle* says that applications for gas franchises for the village of Freeport, L. I., are again multiplying before the Board of Trustees, notwithstanding the fact that two presented within a recent period failed to obtain the favor of the authorities. As was stated in the *Eagle*, at a recent meeting of the Trustees, Samuel R. Smith and other local residents applied for permission to lay mains and supply gas for illuminating and other purposes. At a meeting of the Board last night the Nassau Illuminating and Power Company, by its counsel, Jesse Stearns, of 32 Liberty street, Manhattan, made application for a franchise. Silas B. Dutcher, the well-known Brooklynite, was announced to be the President of the Company, which offered to pay the village 5 per cent. on its gross receipts until September 1, 1910; after that date the percentage to be based on the minimum of $10,000. The Board filed the application."

THE AMERICAN GAS LIGHT JOURNAL

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NOTIFICATION RESPECTING ADVERTISING.

Orders for new advertising, or for changes in standing advertisements, to insure attention in the issue following their reception, must be in hand any time of Wednesday.

AGENTS:
New York—American News Co., 39 and 41 Chambers St.
Germany—Lemcke & Buechner, of New York.
England—Aug. Siegle, 30 Lime Street, London.

MONDAY, MARCH 6, 1905.

The Market for Gas Securities.

The legislators who have in charge the tentative matter of naming the price that shall prevail for gas in the "entire" city of New York do not seem to be impelled by that spirit of unanimity which bodes well for the completion of a noble effort. The Fitzgerald 75 cent bill is, or was out of committee, but the opposers thereto (on legislative account) say, make that rate for every place in the State, and we are with you. There you are. To come to a plain basis of speech on prognostication account, we still remain of the opinion that no change in the rate here will be made this year. Consolidated shows a gain of 8 points for the week. It closed to-day at 212½ to 213. City gas bonds all round show] fair gains.

Brooklyn Union is quoted at 212 to 219, with no stock in sight. Another readjustment of its capital might be made early this summer. Peoples, of Chicago, keeps on the ascending scale, and 85 is still bid for that which is free, of Consolidated, of Baltimore. Laclede preferred is 95 to 100. Cincinnati Gas and Electric is offered at 109.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 WALL STREET, NEW YORK CITY.

MARCH 6.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$73,177,000	100	212¾	213
Central Union, Bonds, 5's.	3,000,000	1,000	108½	110
Equitable Bonds, 6's	1,000,000	1,000	105	..
" 1st Con. 5's	2,300,000	1,000	118	120
Mutual	3,500,000	100	300	320
Municipal Bonds	750,000	..	..	..
New Amsterdam Gas Co.. Bonds, 5's	11,000,000	1,000	112	113½
New York & Richmond Gas Co. (Staten Island)	1,500,000	100	35	.
1st Mtg. Gold Bds. 5 p. ct.	1,000,000	..	..	.
Northern Union, Bonds, 5's.	1,250,000	1,000	104	106
New York and East River.. Bonds 1st 5's	3,500,000	1,000	112	114
" 1st Con. 5's	1,500,000	..	106½	108½
Standard	5,000,000	100	125	130
Preferred	5,000,000	100	145	155
Bonds, 1st Mortgage, 5's	1,500,000	1,000	116	117
Yonkers	299,650	500	130	..
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	212	219
" " Bonds (5's)	15 000,000	1,000	113	115
Bay State	50,000,000	50	—	—
" ncome Bonds	2,000,000	1,000	..	75
Binghamton Gas Works	450,000	100	28	30
" 1st Mtg. 5's	509,000	1,000	93	96
Boston United Gas Co.— 1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	5	5¾
" " Bonds, 5's	5,250,000	1,000	66	68½
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000	..	..
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	104¼
Cincinnati Gas and Electric Co	20,500,000	100	108¾	109
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	97½	99
Columbus (O.) Gas Lt. & Heating Co	1,682,750	100	88¼	89¼
Preferred	3,026,500	100	107½	109
Consumers, Toronto	,000,000	50	200	204
Consolidated, Baltimore	11,000,000	100	85	..
Mortgage, 6's	3,600,000	..	..	118
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490 000	..	..	112
Consolidated Gas Co. of N.J.	1,000,000	100	15	17
" Con. Mtg. 5's	880,000	1,000	89½	92
Bonds	75,000	..	..	100
Detroit City Gas Co	4,825,500	50	..	50
" Prior Lien 5's	5,603,000	1,000	99½	100
Detroit Gas Co., 5's	381,000	1,000	75	75¼
" Inc. 5's	16,000	100	98½	100
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Essex and Hudson Gas Co.	6,500,000	..	39	40
Fort Wayne	2,000,000	..	..	..
" Bonds	2,000,000	..	85	..
Grand Rapids Gas Lt. Co. 1st Mtg. 5's	1,225,000	1,000	104½	105
Hartford	750,000	25	190	200
Hudson County Gas Co., of New Jersey	10,500,000	..	104½	105½
" Bonds, 5's	10,500,000	..	107	108
Indianapolis	2,000,000	..	70	75
" Bonds, 6's	2,650,000	..	106½	108
Jackson Gas Co	250,000	50	82	..
" 1st Mtg. 5's	290,000	1,000	101	102½
Kansas City Gas Light Co., of Missouri	5,000,000	100	..	36
Bonds, 1st 5's	3,822,000	1,000	102	104
Laclede, St. Louis	10,000,000	100	..	..
Preferred	2,500,000	100	95	100
Bonds	10,000,000	1,000	108½	109
Lafayette Gas Co., Ind.	1,000,000	100	..	60
Bonds	1,000,000	1,000	60	65
Louisville	2,570,000	50	136	140
Madison Gas & Elec. Co. " 1st Mtg. 6's	350,000	1,000	107½	108¼
" 6 per cent. scrip, due 1910	100,000	25	85	87
Montreal, Canada	2,000,000	100	218	218¾
Nashville Gas Lt. Co.	1,000,000	100	110	..
Newark, N. J., Con. Gas Co.	6,000,000	..	56	58
Bonds, 6's	4,600,000	..	105	105¾
New Haven	2,000,000	25	200	..
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	109¼	109¾
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,000	1,000	..	..
2d "	2,500,000	1,000	104	
Rochester Gas & Elec. Co.	2,150,000	50	88	..
Preferred	2,150,000	50	118	..
Consolidated 5's	2,000,000	..	87½	90
San Francisco, Cal.	15,800,000	100	58¼	58¾
St. Joseph Gas Co. " 1st Mtg. 5's	751,000	1,000	94	96
St. Paul Gas Light Co.	1,500,000	100	45	47
1st Mortgage 6's	650,000	1,000	113	116
Extension, 6's	600,000	1,000	112½	115
General Mortgage, 5's	2,465,000	1,000	92	93
Syracuse, N. Y.	1,975,000	100	50	55
Bonds	2,047 000	1,000	102	..
Washington, D. C	2,600,000	20	332½	335
First mortgage 6's	600,000	..	..	..
Western, Milwaukee	4,000,000	..	..	..
Wilmington, Del.	600,000	50	220	..

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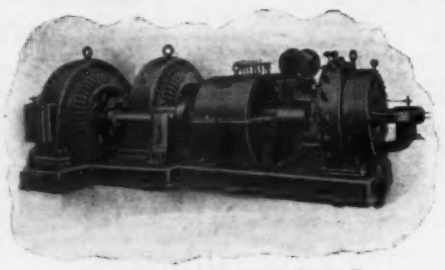

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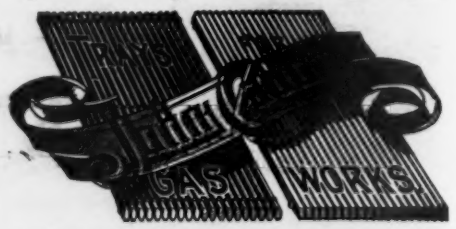

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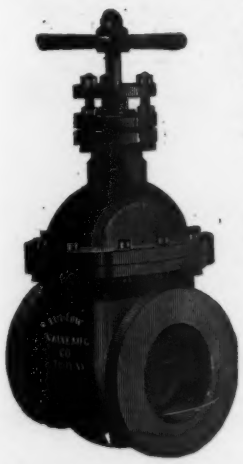

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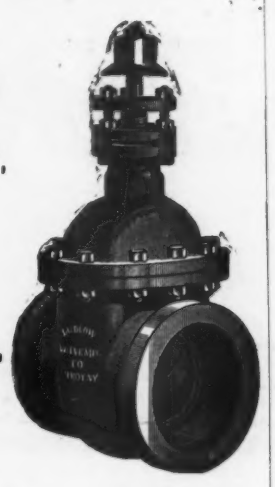

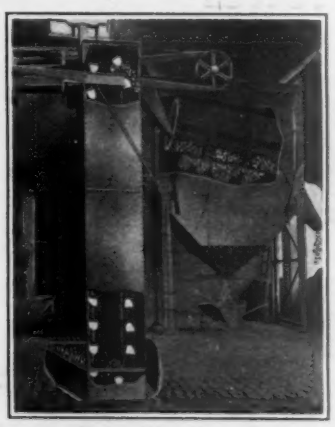

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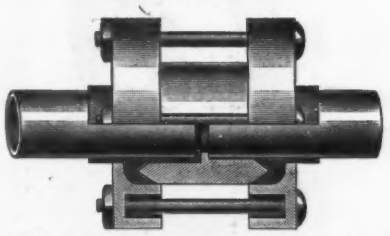

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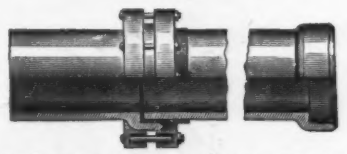

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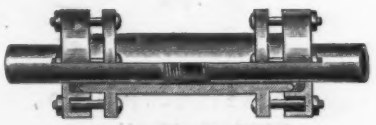
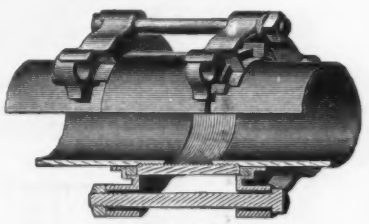
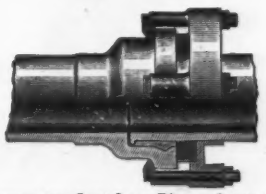


Regular Sleeve. Style 2.



Clamp. Style 4.



Clamps for Cast Iron Pipe. Style 4½.

Pipe Couplings, Sleeves, Clamps, Crosses, Tees and Ells.

My Insulating Coupling prevents the destruction of pipe by electrolytic action, in either water or gas lines.

SEND FOR CATALOGUE.

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Telephone, 204-A TRENTON, N. J., Telephone, 204-A

Constructing Engineer and Contractor.

Estimates Furnished on any kind of Work in Connection with Gas or Water Plants.

SPECIAL ATTENTION GIVEN TO THE REMODELLING AND EXTENDING OF THE PROPERTIES OF WORKS NOT UP-TO-DATE.

CORRESPONDENCE SOLICITED.

LLOYD'S P. & A.

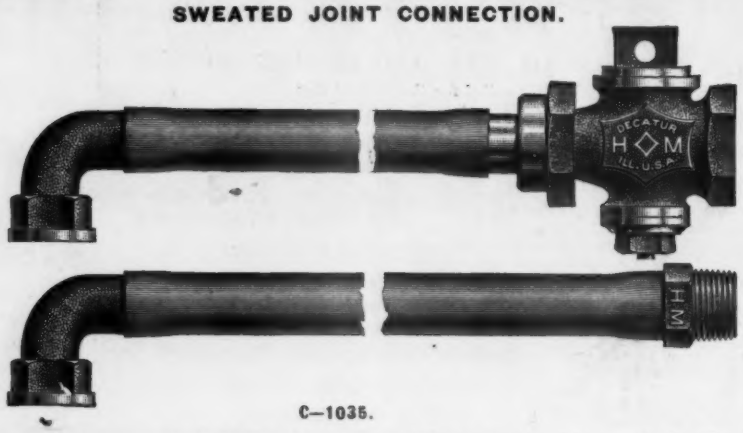
Total daily capacity sold during January, 1905,

40,300,000.

LLOYD CONSTRUCTION CO.,
DETROIT, MICH.

MUELLER GAS METER CONNECTIONS.

SWEATED JOINT CONNECTION.



C—1035.

Among other features in a sweated joint that contribute to its strength is that of even thickness of lead walls around the fittings.

In Mueller Sweated Joint Meter Connections this is brought about with mechanical exactness. The pipe ends are swedged by special machines, with both pipe and tools exactly set to center, making impossible a variation in wall thickness.

Mueller Sweated Joint Meter Connections are made with special pattern shouldered fittings, sweated into the swedged lead pipe. They are made in 270 sizes and specifications. The connections illustrated have quarter bend meter couplings on one end and a male soldering nipple and union meter cock on the other.

Each set of connections is carefully inspected and assembled, is given a 75-pound hydraulic pressure test, bears the Mueller trade mark, and is *unconditionally guaranteed.*

We also make tapping machines and ground key work for gas works' use. Catalogues upon application.

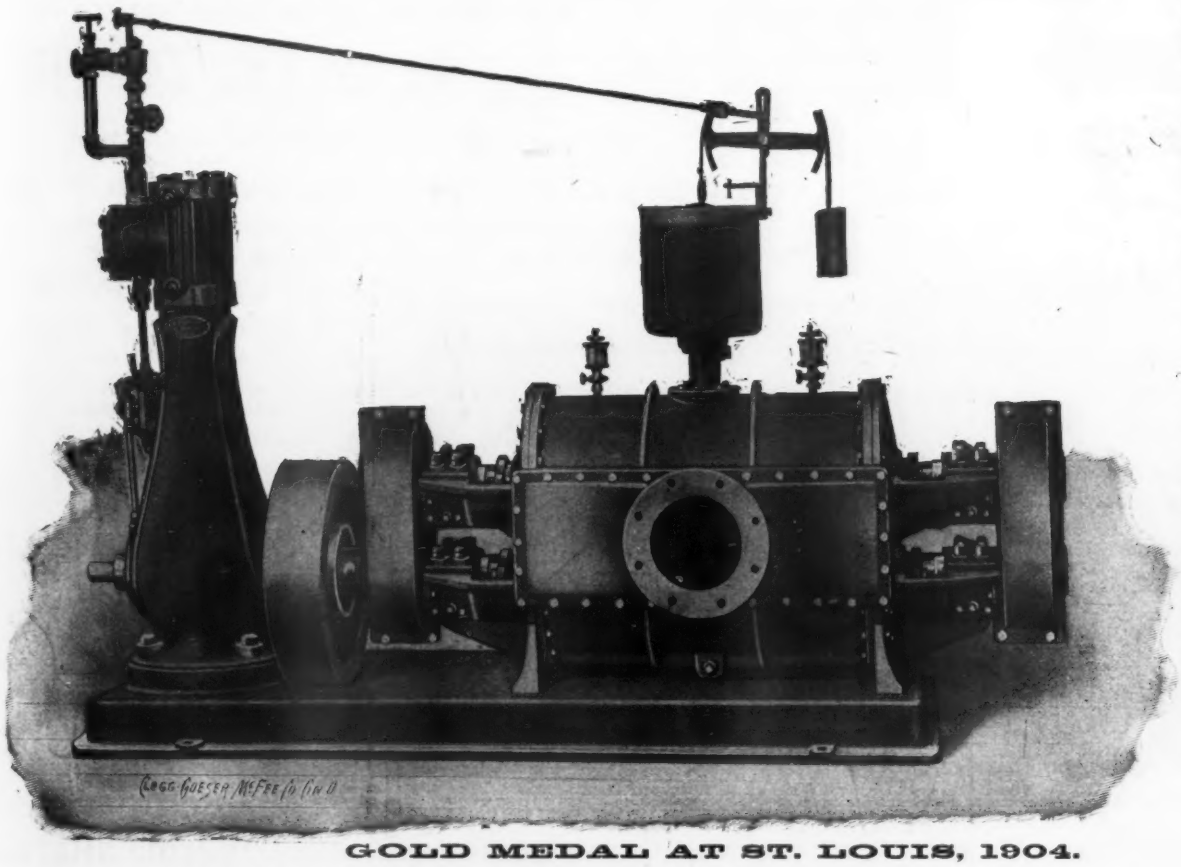
EASTERN DIVISION—Located at 254-258 Canal Street (cor. Elm), New York City, carries a full stock of Mueller goods.

THREE GRAND PRIZES were awarded Mueller Water, Gas and Plumbing goods, respectively, at St. Louis.

H. MUELLER MFG. CO.,

DECATUR, ILL., U. S. A. NEW YORK, N. Y., U. S. A.

ROOTS' GAS EXHAUSTERS.



GOLD MEDAL AT ST. LOUIS, 1904.

Sizes for any required capacity.

Self-oiling, adjustable bronze bearings.

Most perfect and sensitive Governor.

Write for Catalogue.

P. H. & F. M. ROOTS COMPANY,

HOME OFFICE:
Connersville, Ind.

NEW YORK OFFICE:
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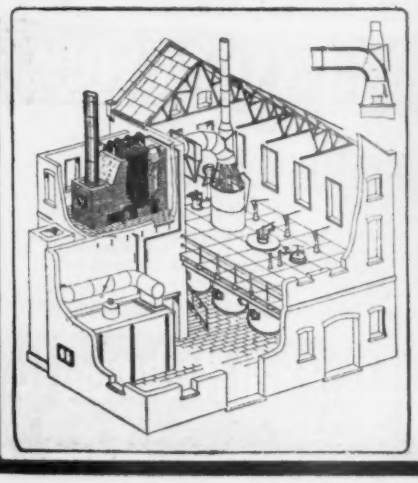
CHICAGO OFFICE:
1547 Marquette Bldg.

USE YOUR OWN

JUDGMENT.

We can send you scores of testimonials from customers, but if you are not yet using our attachments we will send you a sample, free. Try it. If not the BEST you have ever used, we will not expect your trade. :: :: :: :: :: :: Long warning to consumers, entirely preventing fatal accidents. Other important features.

REEVES MFG. CO., - - - - - New Haven, Conn.



Steam + Fuel

Green's Fuel

Economizer.

This view shows installation in Poughkeepsie Gas Works connected with one six-foot U. G. I. set.

25 per cent. less fuel has been used since its installation in March, 1900.

Our expert's services are always obtainable free of charge. May we send booklet?

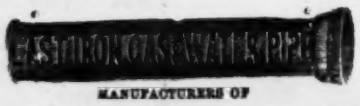
THE GREEN FUEL ECONOMIZER CO.,

Sole Manufacturers in the United States. MATTEAWAN, N. Y.

GEORGE ORMROD, Mangr. & Treas., Emaus, Pa.
JOHN DONALDSON, Prest., Betz Bldg., Phila., Pa.

EMAUS PIPE FOUNDRY.

DONALDSON IRON COMPANY. EMAUS, PA.



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CAST IRON PIPE AND SPECIAL CASTINGS

FOR WATER AND GAS.

Also, FLANGE PIPE, LAMP POSTS, Etc.

GAS TAPPING MACHINES

—FOR—

Drilling and Tapping Pipe under Pressure

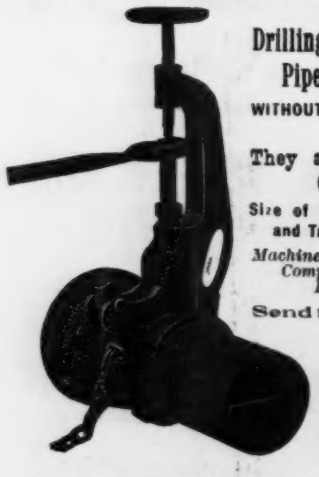
WITHOUT ANY ESCAPE OF GAS.

They are Strong and Compact.

Size of Combination Drills and Taps ¾ to 4-inch.

Machines Sent to any Gas Company for Thirty Days' Trial.

Send for Circulars.



Geo. Light,
DAYTON, O.

THE ECONOMICAL GAS APPARATUS CONSTRUCTION COMPANY, LIMITED,

Consulting Engineers.

Builders of UP-TO-DATE Machinery and Appliances for Coal and Water Gas Plants. :: :: :: :: ::

PLANS,
SPECIFICATIONS
AND ESTIMATES
PREPARED.

AMERICAN OFFICE:
269 Front St., East, Toronto, Canada.

FREDERIC EGNER,
Gas Engineer,
NORFOLK, VA.,

May be consulted with reference to estimates of cost for new, or appraising actual value of existing works; utility of proposed or patented processes; relative earning power to capitalization, and management.

J. F. W. JOST,
CHEMICAL ENGINEER
—IN—
GAS MANUFACTURE,
P. O. BOX 2043. PHILADELPHIA, PA.

WARREN FOUNDRY AND MACHINE CO.,

Established 1856. Works at Phillipsburgh, N. J.

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CAST IRON WATER AND GAS PIPE,

FROM THREE TO FORTY-EIGHT INCHES DIAMETER. ALSO, ALL SIZES OF

Flange Pipe for Sugar House and Mine Work. Branches, Bends, Retorts, etc., etc.

UNIVERSAL PIPE HAS

METALLIC JOINTS
THAT DO NOT LEAK.
WRITE FOR NEW CATALOG.

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Flanged Pipe and Fittings, Hydrants, Gates, Pig Lead, Jute, etc.

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Manufacturers of Lead Pipe, Solder, etc., and Jobbers of Plumbers' and Tinners' Goods.

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Wholesale Eastern Agents AKRON VITRIFIED SEWER PIPE.

SAFETY GAS MAIN STOPPER COMPANY,

For Shutting Off Gas in Mains Temporarily during alterations and repairs. : : : :

Any size gas main can be shut off in 30 seconds. : : :

STOPPERS SENT ON TRIAL.

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FOX HILL FOUNDRY,

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HOBOKEN, N. J.

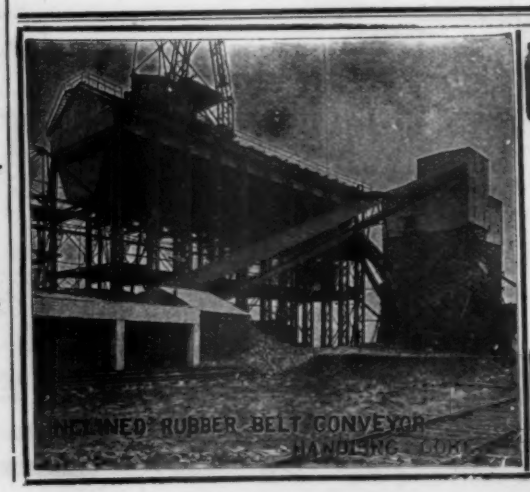
FINE OPENING

GRATE BARS

FOR GAS WORKS.

STATIONARY, SHAKING, DUMPING.

BARS FOR HAZELTON BOILERS.



BELT CONVEYORS

EQUIPPED WITH

BALL BEARING ROLLS

ARE THE BEST,

because they possess greater efficiency, consume less power, and the belts last longer than when any other type of roll is employed.

PLANS AND ESTIMATES FURNISHED ON REQUEST.

The Link-Belt Machinery Co.

Link-Belt Engineering Co. Philadelphia Chicago U.S.A.

AMERICAN METER CO.,

NEW YORK, ST. LOUIS, PHILADELPHIA, SAN FRANCISCO, CHICAGO,

Photometrical and Experimental Apparatus.

PUBLIC LIGHTING TABLE.

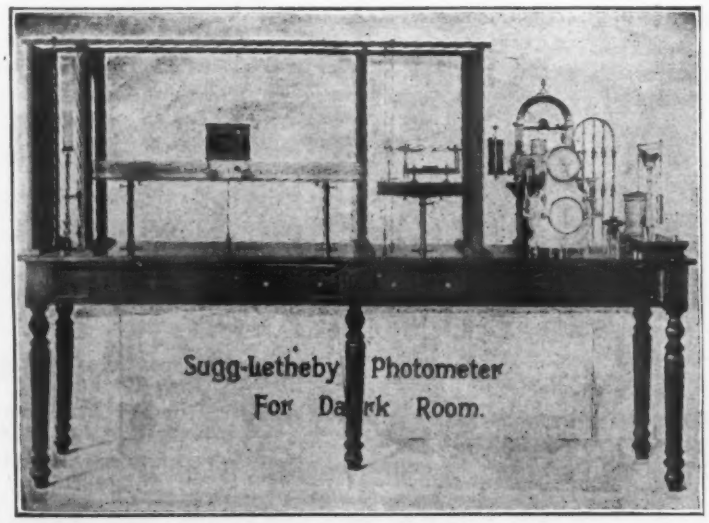
MARCH, 1905.

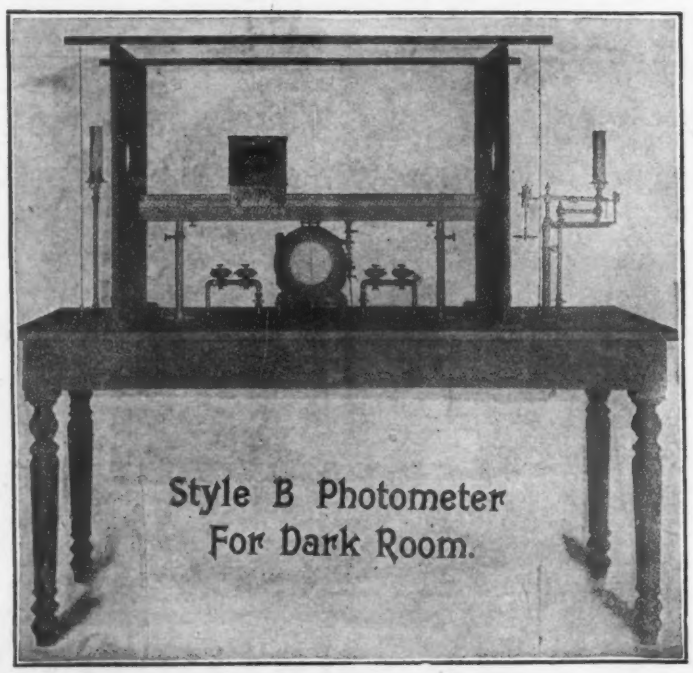
Day of Week.	Date.	Table No. 1. FOLLOWING THE MOON. Light.	Extinguish.
Wed.	1	6.20 PM	5.20 AM
Thu.	2	6.20	5.30
Fri.	3	6.20	5.30
Sat.	4	6.20	5.30
Sun.	5	6.30 NM	5.20
Mon.	6	6.30	5.20
Tue.	7	6.30	5.20
Wed.	8	6.30	5.20
Thu.	9	6.30	5.20
Fri.	10	9.10	5.20
Sat.	11	10.10	5.20
Sun	12	11.10	5.10
Mon.	13	12.00 FQ	5.10
Tue.	14	1.00 AM	5.10
Wed.	15	1.50	5.10
Thu.	16	2.40	5.10
Fri.	17	3.20	5.10
Sat.	18	4.10	5.10
Sun.	19	No L.	No L.
Mon.	20	No L. FM	No L.
Tue.	21	No L.	No L.
Wed.	22	6.40 PM	9.10 PM
Thu.	23	6.40	10.30
Fri.	24	6.40	11.30
Sat.	25	6.40	12.40 AM
Sun.	26	6.50	1.40
Mon.	27	6.50 LQ	2.30
Tue.	28	6.50	3.20
Wed.	29	6.50	4.00
Thu.	30	6.50	4.40
Fri.	31	6.50	4.40

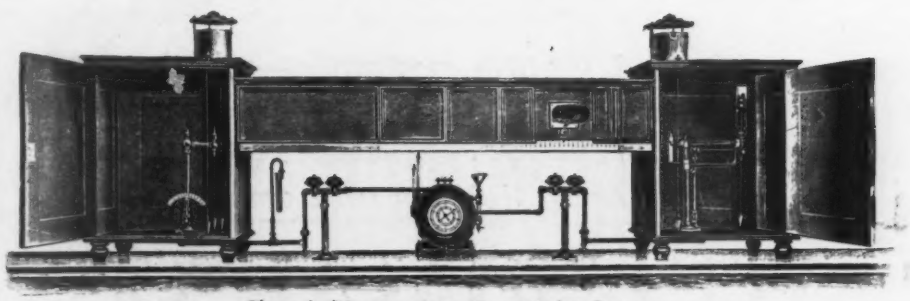
TOTAL HOURS DURING 1905.

By Table No. 1.

	Hrs.Min.
January	240.50
February	192.20
March	207.00
April	175.10
May	161.00
June	139.50
July	149.00
August	161.50
September	173.00
October	205.00
November	211.00
December	229.00
Total, yr.	2245.00







Closed Photometer For Light Room.

CIRCULARS SENT ON REQUEST.

PUBLIC LIGHTING TABLE.

MARCH, 1905.

Day of Week.	Date.	Table No. 2. NEW YORK CITY. All Night Lighting. Light	Extinguish.
		P.M.	A.M.
Wed.	1	5.30	5.45
Thu.	2	5.30	5.45
Fri.	3	5.30	5.45
Sat.	4	5.30	5.45
Sun.	5	5.40	5.35
Mon.	6	5.40	5.35
Tue.	7	5.40	5.35
Wed.	8	5.40	5.35
Thu.	9	5.40	5.35
Fri.	10	5.40	5.35
Sat.	11	5.40	5.35
Sun.	12	5.50	5.20
Mon.	13	5.50	5.20
Tue.	14	5.50	5.20
Wed.	15	5.50	5.20
Thu.	16	5.50	5.20
Fri.	17	5.50	5.20
Sat.	18	5.50	5.20
Sun.	19	6.00	5.10
Mon.	20	6.00	5.10
Tue.	21	6.00	5.10
Wed.	22	6.00	5.10
Thu.	23	6.00	5.10
Fri.	24	6.00	5.10
Sat.	25	6.00	5.10
Sun.	26	6.10	4.55
Mon.	27	6.10	4.55
Tue.	28	6.10	4.55
Wed.	29	6.10	4.55
Thu.	30	6.10	4.55
Fri.	31	6.10	4.55

TOTAL HOURS DURING 1905.

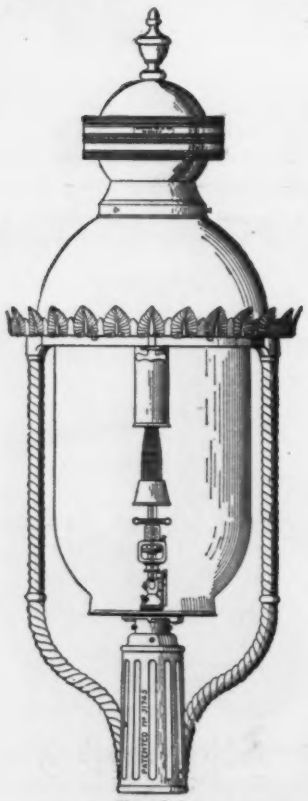
By Table No. 2.

	Hrs.Min.
January	423.20
February	355.25
March	355.35
April	298.50
May	264.50
June	234.25
July	243.45
August	280.25
September	321.15
October	374.30
November	401.40
December	433.45
Total, yr.	3987.45

NEW YORK, 97 Liberty Street. BOSTON, 814 Beacon Building. PHILADELPHIA, Broad and Arch Streets. ST. LOUIS, 712 Roe Building. CHICAGO, Foot of Orleans Street. SAN FRANCISCO, 712 Polk Street.

WELSBACH STREET LIGHTING COMPANY

.... OF AMERICA ....



No. 36.

Controls and Operates the

Welsbach System of Street Lighting,

Which includes its specially DESIGNED AND PATENTED BURNER for STREET and PARK LIGHTING exclusively.

Uniformly SUCCESSFUL in 150 Cities and Towns.

By means of the Welsbach System of street lighting the superiority of GAS over electricity for street lighting has been fully demonstrated.

POINTS OF MERIT:

It is { Economical, Attractive, Successful, Up-to-date.

IT LIGHTS THE STREET.

Where there are no gas mains we can furnish an equally good light by our SELF-GENERATING NAPHTHA WELSBACH BURNER, and thereby supply a uniform light in all localities.

Correspondence Solicited from Gas Companies and Others interested in Municipal and Outside Lighting.

No. 38.

AN underlying principle in business is to show an increase each year---to grow. The astute dealer not only seeks to retain this year's customers, but to attract new trade next year.

The formula is simple---

THIS SHIELD IS THE WELSBACH TRADE MARK.

IT IS A GUARANTEE AND A PROTECTION.

Sell The Welsbach Brands.

The imitation stuff is bad for the customer---which is bad for you.

The genuine Welsbachs---Burners or Mantles---make satisfied customers---keep customers---MAKE NEW ONES.

And your profit isn't merely dollars and cents.

WELSBACH CO.,

Broad and Arch Sts., PHILADELPHIA.

THE UNITED GAS IMPROVEMENT COMPANY

For the Year Ending December 31st, 1904, has been Awarded Contracts for 45 Sets of

Standard Double-Superheater Lowe Water Gas Apparatus.

PARTIAL LIST OF PLACES:

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Pelham, N. Y.
Reading, Pa.
Augusta, Me.
Bangor, Pa.
Woonsocket, R. I. (2d contract).
Brooklyn, N. Y. (4th contract).
Cincinnati, O. (2d contract).
Scranton, Pa. (3d contract).
New York City (14th contract).
New Haven, Conn. (2d contract).
Watertown, N. Y.
Tampa, Fla. (3d contract).
Westchester, N. Y. (3d contract).
Bridgeport, Conn. (2d contract.)
St. Paul, Minn. (2d contract).
Springfield, Mass. (2d contract).
Lynn, Mass. (5th contract).
Rochester, N. Y.
Battle Creek, Mich.
Mechanicsburg, Pa.
Excelsior Springs, Mo.
Bristol, Conn.
Jersey Shore, Pa.
Vicksburg, Miss.

TOTAL SETS, 1904, ... 45
TOTAL DAILY CAPACITY, 1904, ... 56,325,000 cubic feet.
TOTAL SETS TO DATE, ... 553
TOTAL DAILY CAPACITY, ... 419,180,000 cubic feet.

The United Gas Improvement Company,

Broad and Arch Streets, Philadelphia

Established 1858. Incorporated 1890.
CHAS. E. GREGORY, Prest. DAVID R. DALY, V.-Prest. & Treas.
H. D. ABERNETHY, Sec.

J. H. Gautier & Co.

Greene & Essex Streets,
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CLAY GAS RETORTS, FIRE CLAY TILES,
FIRE BRICK and FIRE CLAY SPECIALTIES.

Ground Fire Clay, Fire Sand and Ground Fire Brick in Barrels and Bulk.

SOLE MANUFACTURERS OF THE

FLEMMING GENERATOR GAS FURNACE

Brooklyn Fire Brick Works,

OFFICE AND WORKS:
88 VAN DYKE ST., BROOKLYN, N. Y.
MANUFACTURERS OF

CLAY GAS RETORTS & SETTINGS, GENERATOR LININGS. SPECIALTIES.

Established 1854. Incorporated 1869.

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Fire Brick Manufg. Co.,

Manufacturers of { GAS RETORTS . .
FIRE BRICK . . .
RETORT SETTINGS

Water Gas Cupola Linings, Fire Clay, Etc.

Proprietors for the U. S., Coze System of Inclined Benches.

Estimates Furnished on Application for Most Successful Style of Construction.

Also for Free-Firing and Full and Half-Depth Regenerative Benches, for Burning either Coal or Coke in the Furnaces.

Office:
Cor. Manchester and Sulphur Avenues, St. Louis, Mo.

GEORGE R. ROWLAND,
Formerly with the Continental Iron Works.
Draughtsman and Constructing Engineer.

Drawings, Specifications and Estimates furnished for the construction of new works or alteration of old works. Special attention given to Patent Office drawings.

Office, No. 245 Broadway, N. Y. City.

FIELD'S ANALYSIS FOR THE YEAR 1903.

An Analysis of the Principal Gas Undertakings in England, Scotland and Ireland. Being the 35th year of publication. Compiled and arranged by JOHN W. FIELD, Sec'y and Gen. Mgr. of The Gas Light and Coke Company, London. Price, $5. For Sale by
A. M. CALLENDER & CO., 42 Pine St., New York City.

Adam Weber Sons.

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WORKS: Weber, N. J.

ERECTION OF

Modern Coal Gas Plants,

With either Horizontal, Inclined or Vertical Retorts.

PATENTS APPLIED FOR.

No. 1. Firing horizontal benches with pulverized fuel, with either 8 or 10 retorts in 1 setting, using one furnace for two benches. Great saving in labor, fuel and life of retorts and settings. No elaboration of complex recuperation.

No. 2. Independent retort settings, taking all weight from retorts.

No. 3. Vertical retorts with vertical charge and discharge. Sixteen retorts in one bench.

MODERN BENCH IRONWORK.

ISAAC C. BAXTER, President. ESTABLISHED 1864. PETER YOUNG, Secretary and Treas.

Works.
LOCKPORT STATION, PA.

JAMES GARDNER, JR., CO.,

Successor to WILLIAM GARDNER & SON.

Address all communications to
JAMES GARDNER, JR., CO., Room 202 Lewis Bldg.,
PITTSBURG, PA.

Fire Clay Goods for Gas Works.

HENRY MAURER & SON,

(ESTABLISHED 1856.)

EXCELSIOR FIRE BRICK & CLAY
RETORT WORKS

WORKS, Perth Amboy, N. J.
OFFICE, 418 to 422 East 23d St., N. Y.

Clay Gas Retorts,
BENCH SETTINGS,
Fire Brick, Tiles, Etc.

GEROULD'S IMPROVED RETORT CEMENT

A Cement of great value for patching retorts, putting on mouthpieces, making up all bench-work joints, lining blast furnaces and cupolas. This cement is mixed ready for use. Economic and thorough in its work. Fully warranted to stick.

Price List, f.o.b. BLOOMINGTON, INDIANA.
In Casks, 400 to 800 pounds, at 5 cents per pound.
In Kegs, 100 to 200 " " 6 " "
In Kegs less than 100 " " 7 " "

C. L. GEROULD, BLOOMINGTON, IND.

For orders East of Buffalo, N. Y., or Pittsburg, Pa., freight will be paid to these points.

Bristol's Recording
PRESSURE GAUGE.

For continuous records of Street Gas Pressure.

Simple in construction, accurate in operation and low in price.

Fully Guaranteed. Send for Circulars.

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Waterbury, Conn.

Silver Medal, Paris Exposition.

GASHOLDER TANKS AND GAS WORKS MASONRY COMPLETE.

Plans prepared and Estimates furnished at short notice.

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238 Java Street, Brooklyn, N. Y.

THEO. J. SMITH, Prest. J. A. TAYLOR, Sec
A. LAMBLA, Vice-Prest. and Supt.

BALTIMORE
RETORT & FIRE BRICK CO.

MANUFACTORY AT
LOCUST POINT, BALTIMORE, MD.

Clay Retorts, Blocks & Tiles

FIRE BRICK, FIRE CLAY, AND FIRE CEMENT.

Our Improved Half and Full Depth Benches have been Adopted by Many Gas Companies.

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Sole Agents for New England States.

1904 DIRECTORY 1904

OF AMERICAN GAS COMPANIES.

Price, - - - - - - - - - $5.00.

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Bronder Patent Stoking Machinery.

Three-Scoop and Three-Rake Charging and Discharging Machines are operating in New York, Newark, N. J., Philadelphia, Worcester, Mass., Mt. Vernon, N. Y., Toronto and Montreal, Canada.

Four-Scoop and Four-Rake Charging and Discharging Machines are operating in Detroit, Mich.

These are the only machines that will draw or charge simultaneously 3 or 4 retorts (vertically) and handle from 42 to 60 retorts in from 25 to 30 minutes, lid opening and closing and filling of furnaces included.

Hot Coke Conveyor, Quencher and Steam Exhauster, operating in Toronto, Canada, working in water-sealed flue, rollers being protected from heat and grit.

COAL CRUSHERS, CONVEYORS AND BINS. TURNTABLES FOR MACHINES.

Labor-Saving Machines for Handling Coal and Coke from Coal Cars to Coke Yard or Bins, a Specialty.

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Contracting Engineer and Builder,

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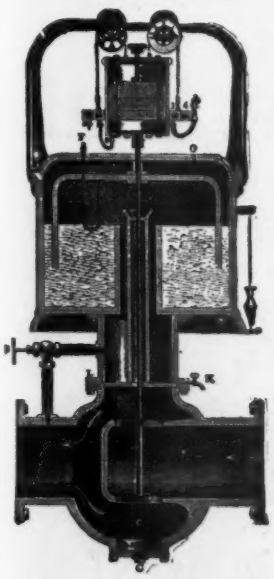
CONNELLY IRON SPONGE AND GOVERNOR CO.,



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— OF —

COAL AND WATER GAS PLANTS,

AUTOMATIC BALANCE, HIGH PRESSURE AND SERVICE GOVERNORS,

ROOTS' IMPROVED EXHAUSTERS.

IRON SPONGE FOR GAS PURIFICATION, JONES JET PHOTOMETERS, PRESSURE REGISTERS, ETC.,

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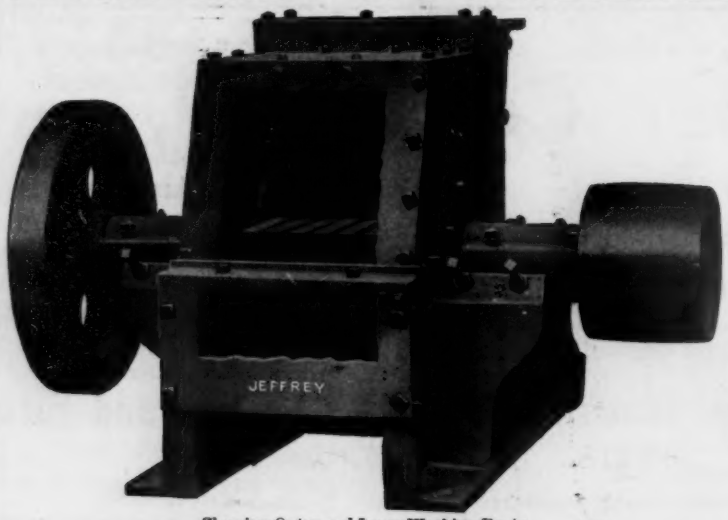

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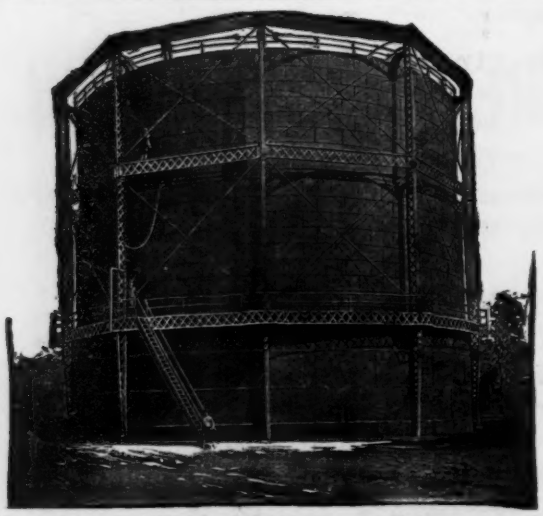

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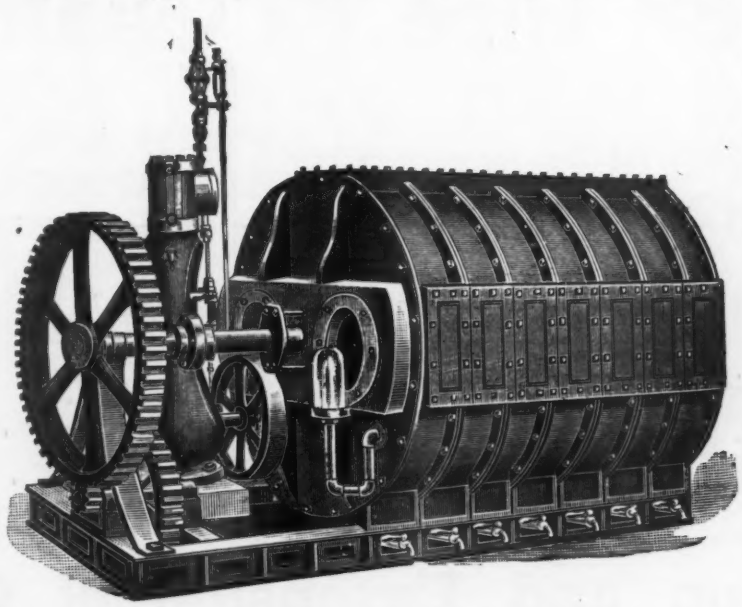

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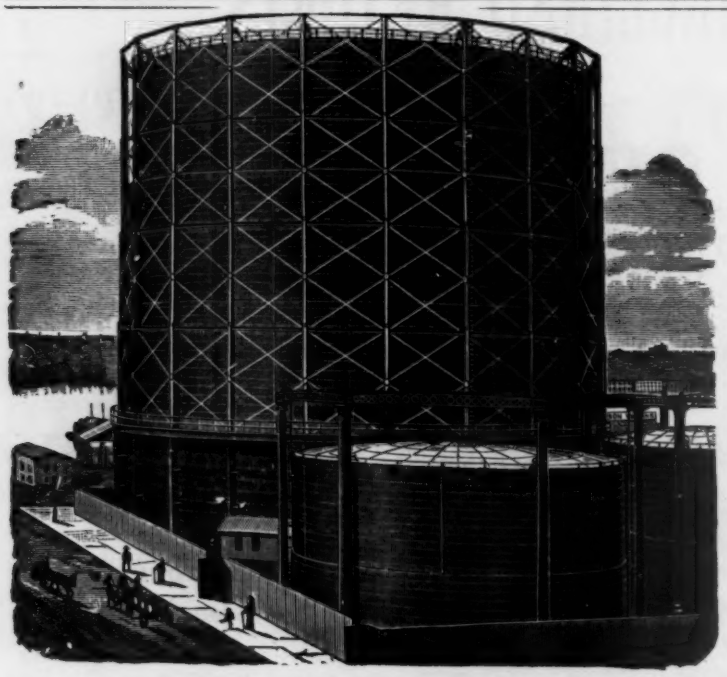

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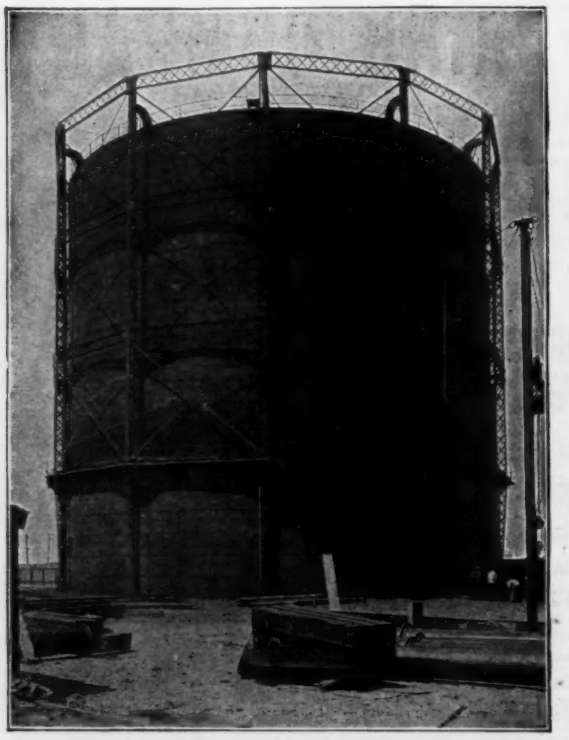

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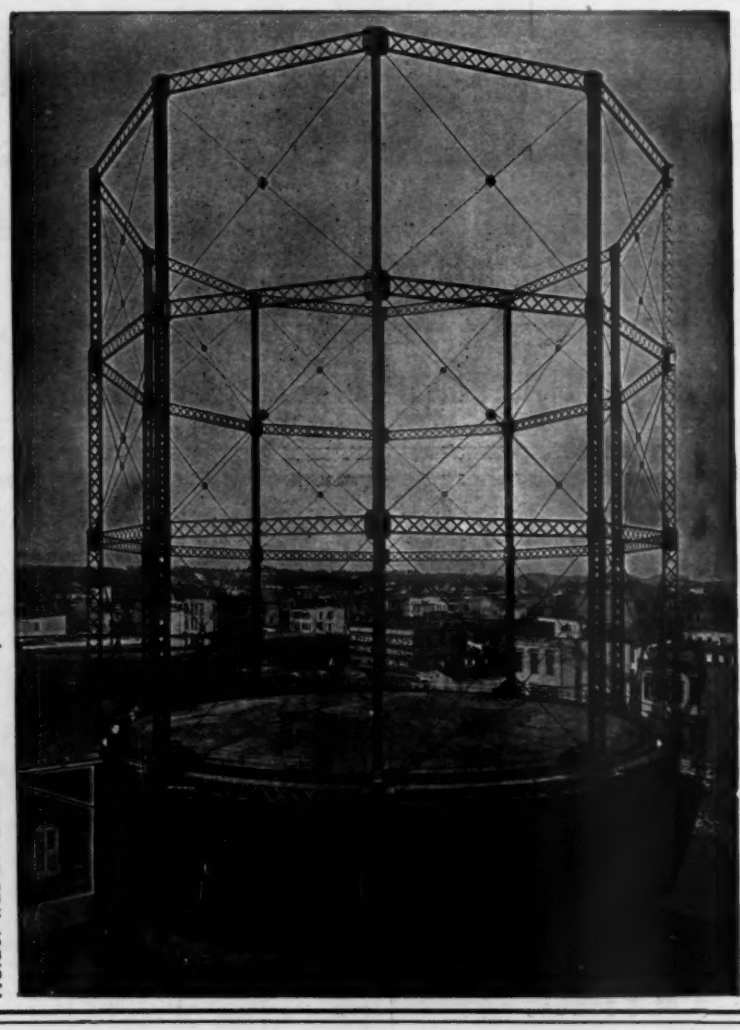

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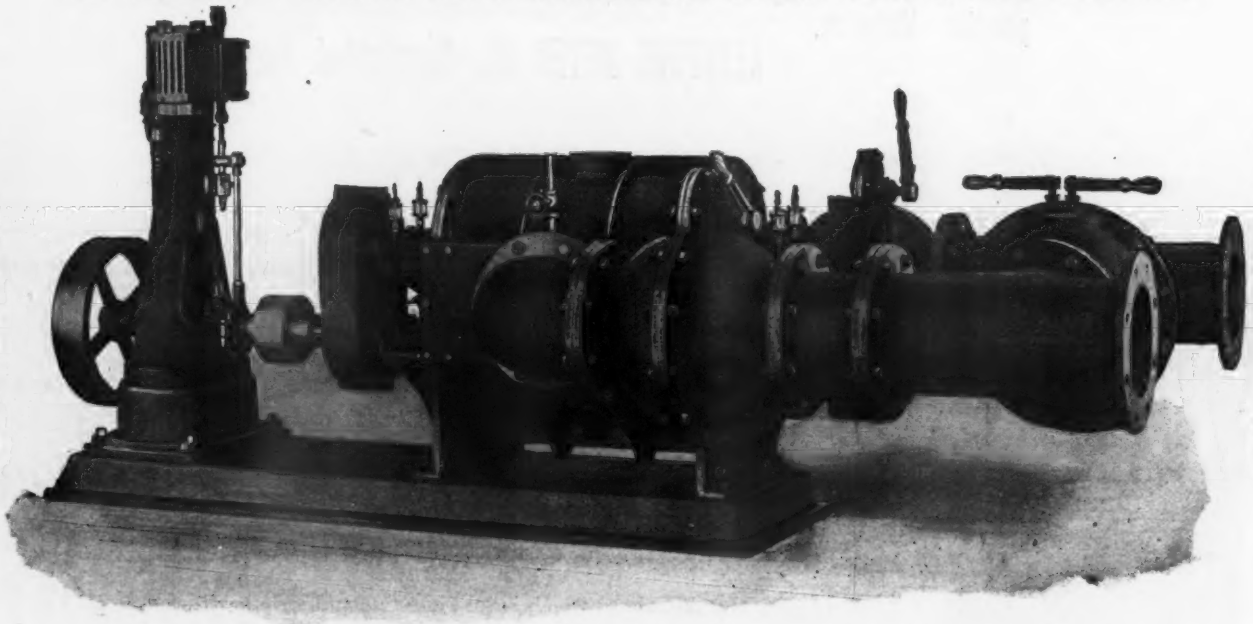

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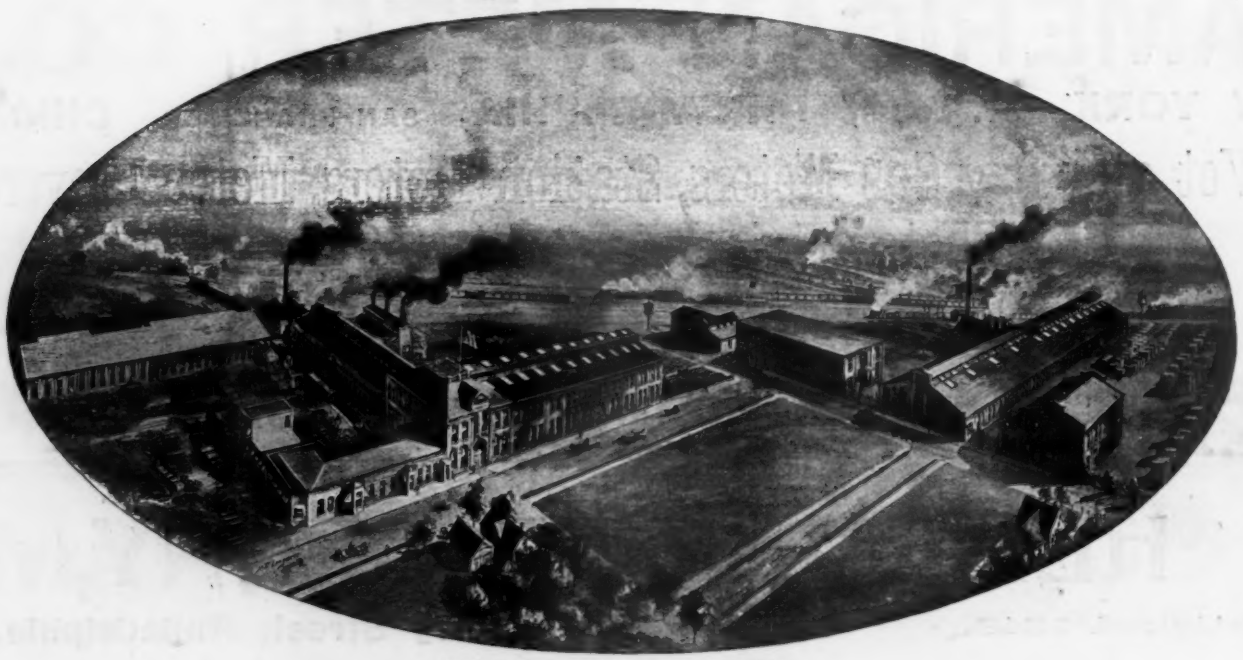

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